Service Provision and Consumer Behaviour in a Frontier area: Northwestern Ontario

(Volume I)

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Doctor of Philosophy

University of Edinburgh
1972

Declaration

I affirm that the composition of this thesis is my own work and that it is based on research conducted and directed by me.

Ivor G. Davies

Preface

The evanescent impression of Northwestern Ontario is that of an unpromising environment within which to pursue research into service provision and consumer behaviour because most settlements do not appear to be service centres, as the term is commonly conceived, and because the area contrasts so strongly with the type of conditions against which most researchers have chosen to test theoretical formulations concerning service provision and consumer behaviour. The more durable impression of Northwestern Ontario, however, is that while it does incorporate special features relating to its frontier character into its systems of service provision and patterns of consumer behaviour, it does exhibit certain of the characteristics of non-frontier areas.

When the writer was planning the present study he became aware of the Ontario Government's wider study of Northwestern Ontario under the Design for Development programme and the writer's study was merged with this wider investigation to avoid duplication and over-surveying the population. Association with this wider study brought the benefit of generous financial assistance tempered by the very reasonable necessity to conform to the requirements of the Ontario Regional Development Branch's study area and data needs.

The study reported here, then, may be regarded as an outgrowth of a compromise between the needs of a regional plan and the needs of a geographical study, within which the provision of information is balanced by attempts to test theory.

Acknowledgements

In conducting the research on which this thesis is based and in the preparation of this manuscript the writer received considerable co-operation and assistance from individuals and groups. Specific and general acknowledgements are provided in notes and Appendix 7 but it is not invidious to make especial mention of those to whom a debt of gratitude is due.

Professor J. Wreford Watson encouraged the writer to emigrate to Canada and has done much to promote this study through his own writings and by his advice and encouragement to the writer.

Dr. Richard S. Thoman and the Ontario Regional Development Branch provided the writer with generous financial assistance for the field-work and assured the writer of official goodwill in Northwestern Ontario.

The Canada Council provided a generous doctoral fellowship enabling the writer to spend one year in Edinburgh composing this manuscript.

Guy S. Davis and Norman Brown devised programmes for analysis of the writer's data on Lakehead University's IBM 360/60 computer.

Elizabeth M. Sulpher (nee Wear) impeccably typed field-notes, questionnaires and penultimate drafts of this manuscript.

Marianne Wahl rendered signal cartographic assistance, particularly in the preparation of the desire line maps in Chapter Four.

Morag Alexander read the penultimate draft of this manuscript, eliminating grammatical errors and inconsistencies and eradicating the writer's more archaic usages.

To the above the writer extends his gratitude; and he also extends his thanks to the people of Northwestern Ontario who answered his questions.

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ABSTRACT

Most geographical research on service provision and consumer behaviour has been performed in non-frontier areas. Northwestern Ontario's frontier character, established on the bases of the writer's experience and past and present appreciations of the region by other minds, is best exemplified by its low population density, its lack of continuous administrative organisation at the local level and the irregular locational pattern of its settlements, many of which are of recent origin.

Research goals and techniques for this investigation were selected from a wide array presented in literature dealing mainly with non-frontier areas and adapted, where necessary, to suit Northwestern Ontario's special conditions. Data on service centre equipment and on selected aspects of consumer behaviour were obtained in a major survey, conducted in 1968, employing carefully-controlled and standardised techniques.

Elemental and aggregate analyses of service equipment, supported by analyses of the structure of consumer behaviour, suggest that goods and services in the region are provided by systems of service centre tending towards a hierarchical arrangement. These systems resemble those of non-frontier areas in some respects but possess certain features related to Northwestern Ontario's frontier nature.

Description and analysis of consumer behaviour in the region's two main areas of dispersed population reveal a variety

of spatial and structural patterns in the Rainy River area which contrasts with the similarity of those at the Lakehead. Description and analysis of the spatial and structural consumer behaviour patterns of the region's nucleated population demonstrate the existence of two major tributary areas, focusing on the Lakehead and Winnipeg, and allow comparisons amongst service centres and orders of service centre. The validity of these results is confirmed by an apparent lack of temporal variation in consumer behaviour and by apparent lack of variations occasioned by cultural and socio-economic differences within the Northwestern Ontario population.

Comparison of the Northwestern Ontario findings with those for non-frontier areas is rendered difficult by incompatible terminology and measures; and by intrinsic features of the Northwestern Ontario data, which tend to emphasise its divergence from conditions in non-frontier areas.

CHAPTER 1

REGIONAL SETTING

INTRODUCTION

Whereas the frontier in the United States moved mainly westwards, the frontier in Canada has moved both westwards and northwards. In Canada, as in the United States, the frontier has been and still often is composed of several economic activities, particularly agriculture, mining and forestry, and these separate elements have been the subject of general and systematic study by geographers. In Northwestern Ontario several frontiers co-exist, and the present study is conceived within this framework.

It is the primary aim of this study to explore the geographical aspects of service provision and consumer behaviour in a frontier area. The geographical aspects of service provision are here taken to mean the way in which establishments providing goods and services are arranged in space and, similarly, the geographical aspects of consumer behaviour are taken to mean the way in which consumers react to the space between their dwellings and service establishments.

Most geographical studies in this field have tended to concentrate on either service provision or on consumer behaviour; moreover, they have usually been carried out in areas of long-established settlement or in closely-settled areas -- in areas with characteristics closely resembling the specifications of the central

place model. A notable exception is the work of Burton (1963) which attempts to modify the central place model for irregularly- and closely-spaced towns, in what might be called a marginal case. On the frontier, not only are closely-spaced towns to be found, but so too are widely-spaced towns; so widely-spaced that individual towns seem to deserve the appellation "isolated". Under such conditions of irregular spacing and under the other conditions of life on the frontier, the geographical aspects of service provision and consumer behaviour merit special study: to identify their characteristics; to relate these characteristics to the frontier; and to provide a basis of comparison with non-frontier areas.

Northwestern Ontario is comprised of the territorial districts of Thunder Bay, Rainy River and Kenora (including the Patricia Portion), but the area concentrated on in this study lies to the south of the Canadian National Railway (CNR) transcontinental line, except for an outlier to the Red Lake district (Figure 1.1). This concentration stems in part from the necessity to conform to the areal research requirements of the Ontario Regional Development Branch, but stems mainly from the concentration of settlements and activity into the zone south of the railway line.

The frontier is thought to influence service provision and consumer behaviour in special ways. It therefore merits more detailed consideration. Lotz (1970, p.4) for example, appears to view the frontier in terms very similar to those of Turner:

> The frontier is a land where the known meets the unknown, where men's minds must devise new solutions to new problems and build on this for the betterment of all. The frontier is where realism and idealism run together.

The notion of known and unknown meeting, or occurring in close proximity, or applying at different levels of intensity, is one appropriate way of expressing the essence of Northwestern Ontario. There is the contrast between the familiar and open streets of the city of Thunder Bay[1] and the dense bush only twenty miles distant where the unwary and inexperienced -- and sometimes even the experienced -- find it easy not to find their way. While the whole area has been aerially photographed and maps of it produced at a small scale, the full extent of its natural resources, particularly its mineral resources, are unknown. Again, the carrying capacity of the Northwestern Ontario environments are unknown, the long-term effects of human occupancy are difficult to predict and the fragility of its ecosystems has been brought home only of late.

It is more difficult to exemplify, from Northwestern Ontario examples, the notion that the frontier provides men with a challenge in confronting them with new problems divorced from past experiences and necessitating original and fitting solutions. From the early stages of Northwestern Ontario's development one clear example emerges: the necessity to modify standard railway construction techniques in laying the Canadian Pacific Railway (CPR) track over the rock, lakes and muskeg between Fort William and Winnipeg. Another problem of the frontier, how to exploit natural resources in widely-separated and isolated locations and provide attractive living and working conditions, has been met in Northwestern Ontario

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[1] The twin cities of Port Arthur and Fort William were amalgamated to form the city of Thunder Bay, January 1st, 1970.

by the creation of the modern company town. But certain aspects of the degree to which company towns meet their objectives have not yet been thoroughly investigated. To what extent do the residents patronise service establishments located in their own towns and to what extent do they look to other towns, for example? In many respects, though, the observer tends to be impressed by the similarities between the forms of human occupancy of the Northwestern Ontario frontier and Canada's southern ecumene. The major settlements (Thunder Bay, Fort Frances, Dryden and Kenora) are morphologically dominated by the surveyor's grid-iron patterns of streets and thus resemble closely the settlements of the more developed parts of Canada. The paper mills of Terrace Bay, Dryden and Marathon resemble those of southern Canada in their major outlines and in all but the details of their processing procedures. It is true that an arm of Steep Rock Lake was drained to expedite both underground and open-pit mining of iron ore, but the machines and techniques were those of southern Canada and the United States. On balance, techniques, equipment and forms of human occupancy seem to have been developed away from the Northwestern Ontario environment and applied to it.

Perhaps it is in the realm of attitudes, ideas and life styles that the frontier has provided the opportunity for innovation and the development of difference. Hutchison (1957, p.265) expressed his perception of the general differences between southern and northern Ontario in this way:

> They were of every breed, look and language. Though they spoke in English, French, German, Polish and tongues beyond all recognition, all of them bore the unmistakable mark of the north; not physically, but in the texture and slant of the spirit.

Perhaps it might be inferred that Hutchison, in establishing the ethnic diversity of the northern frontier, was implying that ethnic difference could be found along with unifying traits induced by the shared experience of life on the frontier.

I.J. Dawson (1968, p.101) writes of the inhabitants of Port Arthur and Fort William in a similar vein, claiming that "...a community with a unique Northern personality and élan has evolved quite separately and differently from that produced by the Southern Ontario strand". Despite the past rivalries between the cities' institutions and pressure groups, Dawson perceives common and distinctive attitudes. A recent provincial government report (Ontario Department of Treasury and Economics, 1969, p.54) is more positive: it describes

> ...the intangible quality to the style of life in Northwestern Ontario - a conviviality which is generally less common in congested urban regions, a slower pace of life, and a certain pride in being northern and separate in many ways.

In part this feeling of difference is a feeling of advantage. There is a feeling that in Northwestern Ontario the individual is free, not hemmed-in, able to breathe clean air, to swim in fresh water, and to savour the sounds, or the stillness, of the boreal forest. There is a feeling of advantage over the southern Canadian with his long journey to work and for recreation, suffering air pollution and traffic congestion. At the same time the feeling of separateness, reinforced by distance, translates itself into an attitude that the Ontario Provincial Government does little for Northwestern Ontario and could do more; that Ontario as a whole takes more from Northwestern Ontario than it returns. Thus

complaints that the level of provision of social, educational, and health services in Northwestern Ontario compare unfavourably with those in Southern Ontario are matched with distrust of any programmes designed to improve those levels, when the programmes originate in Southern Ontario. Programmes hatched in Toronto are deemed inappropriate by Northwestern Ontario residents. Equally, complaints of provincial government failure to stimulate economic growth are matched by accusations of environmental and life-style destruction when government suggests increasing processing and manufacturing enterprises.

In part the feeling of difference stems from life close to the elements. The ability to endure hardships imposed by nature is a source of pride and is used by those on the frontier to separate themselves from southern city folk. As Watson (1963, p.568) puts it, "the age of the frontier is the age of the frontiers*man*". The capacity to master the ways of the bush -- hunting, fishing, canoeing and trekking -- is the measure of a man. To withstand the long winter, with its low temperatures, blizzards, and deep snowfalls and drifts, is treated as commonplace. The winter is, ostensibly, not allowed to interfere with the enjoyment of life. The bites of blackflies and mosquitoes, thick in the air in the short, hot summer, are shrugged off.

In part the sense of ruggedness is derived from pride in the area's past, when men battled against the elements to make minor imprints on the physical geography and when life was carefree and devil-may-care. Berton (1970, pp. 296-297) describes Rat Portage (now named Kenora) as the roughest town in Canada in 1880; where, over an eight month period, six thousand dollars were collected in

fines for offences such as "highway robbery, larceny, burglary, assault, bootlegging, prostitution."

Rapid and uncontrolled growth followed by decline seem to be an essential ingredient of the development of a frontier area, with initial over-optimism about an area's potential being followed by a period of readjustment to reality. Writing of the Peace River country, C.A. Dawson (1934, p.ix) put it this way:

> The familiar historical occurrences of the premature or false beginning, the long wait for transportation facilities, the land boom and its collapse, the early groping for suitable products, the evolution of mature and stable settlements [*sic*].

Dawson was writing of agricultural settlement and perhaps this explains why some elements of his sequence do not readily accord with the development-sequence of Northwestern Ontario. For example, transportation facilities such as the CPR preceded local economic activity as eastern and western Canada were linked. The railway building period, however, represented a transportation frontier and boom conditions attended it. Construction camps and towns grew up overnight, only to be abandoned when a particular section of track-laying was completed (Berton, 1970, p.295):

> In July, 1880, when the end of the track moved beyond Gull River, Ignace became the capital of Section A. All the inhabitants of Gull River moved - stores, houses, boarding houses, a jewellery shop, a hotel, a telegraph office, a "temperance saloon", a shoemaker and a blacksmith shop. Often, though, communities changed geographical location and names, they re-elected the same public officials to govern them.

Some construction camps persisted as permanent settlements,

although the boom conditions under which they originated bequeathed a morphological legacy for future inhabitants:

> Shanties and tents were built or pitched wherever the owners fancied and without reference to streets or roadways. As a result, the streets were run between the houses as an afterthought so that there was nothing resembling a straight thoroughfare in town.

Thus Berton (1970, pp. 295-296) describes Rat Portage (Kenora) in 1880. Some construction camps, by contrast, fell into virtual disuse, only to be selected for a different type of activity at a later date. For example, Peninsula declined from a population of over 2,000 in the CPR construction heyday of 1880 to forty-three persons in 1943 (Fraser, 1953, p.314) when it was a railway stop and minor fishing port. After the second world war Marathon was constructed on the same site.

Northwestern Ontario, then, has experienced the rapid expansions and contractions that appear integral to the frontier. Settlements have been located more with the exploitation of a particular primary resource in mind than with the need to provide goods and services for other settlements or for a dispersed population, although some settlements may have come to occupy a service role. Without an examination of consumer behaviour it is difficult to know if a settlement's service equipment is adequate for its own population's demands, falls below them or is attractive enough to draw consumers from other settlements. Moreover, on this frontier of Northwestern Ontario long distances separate settlements. How do people perceive and react to these distances, particularly as the distances are modified by climate? Do they don their seven-league boots or do they make do with what is at hand; or do they

use catalogues as a means of avoiding travel and of increasing the array of items available to them?

In the final analysis, Northwestern Ontario is judged a frontier on the basis of a small total population scattered over its vast area in mainly small settlements with restricted and often uncertain economic bases -- settlements founded largely with needs other than service in mind.

If there is any regular distributional pattern at all to the settlements of Northwestern Ontario, it is one of linearity emphasising the main road and rail routes. There is little, if any, regularity in settlement spacing, the precise locations of settlements reflecting the history of development of Northwestern Ontario and site factors such as lakes, rivers and mineral occurrences. The two main through-routes, consisting of both road and rail, interconnect most of the region's principal settlements. In the east, the CPR mainline and Highway 17 (the Trans-Canada) flank the shores of Lake Superior, while the Canadian National Railway subsidiary line and Highway 11 cross the height of land and bend southwards to avoid the expanse of Lake Nipigon to join the southern route in the vicinity of Nipigon (Figure 1.2). Highway 11/17 and the two rail lines concentrate east-west transport between Nipigon and the Canadian Lakehead, and at the latter location the routes diverge; Highway 11 and the CNR line heading almost due west for the Fort Frances area, and Highway 17 and the CPR striking out northwestwards for Winnipeg through Kenora and Dryden. At the region's eastern and western extremities, east-west routes are joined by road, and by rail in one case: in the east a mainly gravel road links Highways 11 and 17 through Manitouwadge, while CNR and CPR branch lines

penetrate to Manitouwadge from north and south respectively; and in the west the recently paved Highway 71 winds its way round the shores of the Lake of the Woods to link Highways 17 and 11. Few settlements are found far from these main through-routes.

In the north of the region the main CNR transcontinental line runs east-west, to the north of Lake Nipigon. Settlements strung out along this line such as Nakina, Armstrong, Savant Lake and Sioux Lookout are connected to the more southerly east-west road axis by north-south roads of varying quality. The Red Lake area stands out as a settlement oasis far to the north of the CNR transcontinental line and is linked with the south by a paved road (Highway 105) and air transport.

The three pockets of pioneer agriculture (at the Lakehead, between Fort Frances and Rainy River, and in the vicinity of Dryden) exhibit the only substantial development of road networks and the roads are mainly of gravel.

The present alignment of settlements are the result of the evolution of Northwestern Ontario's main economic activities (Table 1.1).

Approximately one-third of the region's work force is engaged in retail trade or in providing services. Because the provision of goods and services is the primary concern of this investigation, this aspect of the region's economic acticity is not considered in detail in this introductory chapter.

After services, manufacturing accounts for the largest single category. Of the manufacturing total of 16.69 per cent, 11.18 per cent depends on and is associated with wood production. Apart from the pulp and paper industry, manufacturing is not

TABLE 1.1

NORTHWESTERN ONTARIO: STRUCTURE OF LABOUR FORCE, 1961

Industry	Percent of Total
Agriculture	2.40
Forestry	8.29
Fishing & Trapping	1.19
Mines, Oil Wells & Quarries	5.58
Manufacturing	16.69
Construction	6.69
Transport & Communications	16.21
Trade	13.60
Finance, Insurance & Real Estate	1.83
Services	20.64
Public Administration & Defence	4.30
Other	2.58
Total	100.00

Source: DBS, *Census of Canada*, 1961.

considered in this dissertation because most manufacturing is concentrated at the Canadian Lakehead. Although agriculture, mining and forestry account for small percentages of the total 1961 labour force, in the past they have, singly and in concert, occupied much higher percentages and have exercised great influence in shaping the distribution of settlements. Moreover, fishing and trapping now account for only 1.19 per cent of the labour force, but the fur trade dominated the area's history for an extended period. Each activity -- the fur trade, mining, agriculture, forestry, transportation, and tourism -- is considered separately and in turn, and these separate strands are drawn together in an examination of population growth and settlement development.

The aim in presenting the evolution of the area's economy is to demonstrate how particular locations came to be settled; how some locations were occupied either intermittently or temporarily; and how others, once settled, have experienced enduring occupancy.[1]

It is hoped, in this examination, to demonstrate the frontier character of the area. A frontier area rarely experiences prolonged periods of equilibrium and the notion of equilibrium is important in analyses of service provision and consumer behaviour for under any economic conditions there may be disequilibrium, with provision lagging behind demand initially. On the frontier, with boom conditions, this initial characteristic may be expected to apply with equal or greater force. It may, however, be an enduring characteristic if the long-term prospects of a settlement are in doubt. Equally, good prospects can be nullified almost overnight on the frontier and service provision may be in over-supply as the economic bases of settlements slump dramatically and as population declines.

FUR TRADE ERA: 1670-1869

It is difficult to set precise limits to eras of economic activity, but the beginning of the fur trade for what is now North-

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[1] Most of the historical section is based on secondary sources. Primary sources are few and so widely-scattered and inaccessible that their location, assembly and interpretation is a daunting task for even the professional historian. For example, Dr. Elizabeth Arthur, Professor of History at Lakehead University, has spent four years examining primary sources for the period 1821-1892. The results of this work are in press:
Documents pertaining to the History of Thunder Bay, 1821-1892.

western Ontario is taken here as 1670, the year of the founding of the Hudson's Bay Company; and the end is taken as 1869, in which year the Hudson's Bay Company surrendered its lands to the British Crown. During this period of nearly two hundred years, the most enduring feature was the location of the Hudson's Bay Company posts in the northern parts of Northwestern Ontario, particularly on the shores of Hudson Bay and James Bay. In the area to the south, first the French and then the Northwest Company gave challenge to the Hudson's Bay Company; and as commercial rivalries were pursued, the territory was explored and mapped, routeways were developed and locations and sites of settlements were chosen. Whether because of coincidence, site advantage, or accessibility, some of these early locations have persisted as the seats of economic activities until the present time.

Initial exploration of the southern part of the region was accomplished by the French, and the explorers Radisson and Groseillers are thought to have used the mouth of the River Kaministikwia as a base for their exploration of the Upper Lake Superior country between 1654 and 1656. French occupancy of the southern part was stimulated by the diversion of the flow of furs away from French Canada towards the Hudson's Bay Company's Fort Albany on James Bay; and the initial French response consisted of the building, by Daniel Graysolon, Sieur Du Lhut, of a fortified trading post (Fort Caministagoia, 1678) on the northern bank of the River Kaministikwia close to Lake Superior (McComber, 1923-24, p.14). It may be inferred that this location had low potential as a diversionary point as the post fell into disuse about 1700.

The early French forts in the vicinity of Lake Nipigon

were of greater and longer-lasting importance in diverting the northeastwards flow of furs. In 1678, Charles, Sieur de La Tourette (a brother of Du Lhut) established Fort Caministogoyan on the left bank of the Nipigon River where it flows into Lake Superior; and Forts La Maune (about 1684) and Outouloublis (about 1682) at the northern end of Lake Nipigon (McComber, 1923-24, p.15; Voorhis, 1930). The latter pair, particularly Fort Outouloublis, were intended to block the river route from Lake Nipigon to Hudson Bay, that is the Ombabika - Ogoki - Albany route (Figure 1.3); and Fort Caministogoyan presented an alternative trading point for the Indians.

Although all three of these forts continued to operate until the Franch cession of Canada in 1763, the area to the south-west was not neglected. In 1717 Governor de Vaudreuil and Intendant Begon initiated their *postes du nord* plan by having Robutel de La Noue re-establish the French post on the River Kaministikwia (Fort Kaministikwia); and trade diversion and the search for the western sea were aided by de La Noue's construction of an outpost at Rainy Lake, Fort St. Pierre, in 1718 (Rich, 1961, Vol. 1, pp. 515-517). Fort St. Pierre was either improved on or another structure erected, by La Jemeraye in 1731; and the French presence in the area was consolidated when La Vérendrye, commander of the *postes du nord*, built Fort St. Charles on the western shore of the Lake of the Woods one year later (Burpee, 1963, p.46).

By 1741 the Hudson's Bay Company felt the effects of the *postes du nord* to such an extent that it broke its established policy of locating its posts only by the sea and built the fortified trading post of Henley House on the Albany River about eight miles

below its confluence with the Kenogami River (Rich, 1961, Vol. 1, pp. 533-555).

The Kaministikwia - Rainy Lake - Lake of the Woods - Lake Nipigon posts acted as a secure base for French penetration to and beyond Lake Winnipeg and the posts thrived until the disorganisation caused in Eastern Canada by the Seven Years' War. For example, Fort Kaministikwia was abandoned in 1758. The 1763 French cession, however, did not mean that "...the natural advantages of routes, knowledge and contacts with the Indians had ceased; they merely passed into English hands" (Rich, 1961, Vol. 1, p. 648).

Some of the hands into which the information passed belonged to those who in 1779 formed the North West Company. Campbell, (1957, p.1), describes it thus:

> The Northwest Company never was a company in the modern sense. It had no charter. It was, rather, a series of co-partnerships between small groups of men who were promoters, merchants or fur-traders - explorers...

The Hudson's Bay Company, then, soon discovered that French competition from the south had been replaced by a "Canadian" challenge, particularly from the North West Company. The North West Company's sphere of interest was, initially, divided into two: one branch spread over what is now Northern Minnesota and North Dakota; and the other in what is now Northeastern Ontario and which was focused on Michipicoten on the northeast shore of Lake Superior. The basis of a penetration into what is now Northwestern Ontario was laid by some of the Northwest Company's founders when they began building a Fort at Grande Portage Bay in 1778; a fort, Grande Portage Fort, that was completed in 1784 (Figure 1.4). From this

headquarters trade was organised over Northwestern Ontario and the infilling of the region with North West Company forts ensued: Red Lake House, at the north end of Red Lake (by 1786); Fort Pic, at the mouth of the Pic River and on the northern shore of Heron Bay (by 1790); Rat Portage House (1790-1800) at one outlet of the Lake of the Woods and on the route between that lake and Fort Alexander to the west; Fort Duncan (about 1745) on the northern shore of Lake Nipigon (site uncertain but at either Wabinosh or Windigo Bays); Fort Charlotte (1799) nine miles west of Fort Grande Portage and at the western terminus of the Grande Portage; Long Lake Fort (*circa* 1800), at the River Kenogami's exist from Long Lake on its course to the Albany River, and connected by lake, river and portage to Fort Pic; and Sturgeon Lake Fort (by 1805), on Sturgeon Lake (Voorhis, 1930; Mackay, 1948, pp. 9-15).

In 1803 the North West Company's headquarters were moved northwards from Fort Grande Portage, which was now in United States territory; and the former French Fort Kaministikwia was rebuilt (and renamed New Fort) and used as a base for penetrating westwards via the rediscovered French route of the River Kaministikwia and Dog Lake, (Innis, 1962, pp. 228-229). Rebuilt in 1804, New Fort was renamed Fort William and served as a North West Company rendezvous and wintering place for the next seventeen years. The move had been contemplated for some years, according to Umfréville (1809, p.XII), who had located the Kaministikwia route in 1784. Thus the site of the present city of Fort William was occupied and that occupancy has continued to the present. Moreover, from that location, and particularly via the route of the Kaministikwia Valley, services have been offered to a wider area and long-distance links out of

Northwestern Ontario have been established.

That the Hudson's Bay Company took the competition seriously may be gauged from their spreading south and into the interior, building, amongst others, Nipigon House (1775-1785) on the northern shore of Lake Nipigon; Osnaburgh House (1786) on the eastern shore of Lake St. Joseph; and Pointe de Meuron House, close to Fort William.

In 1821 the North West Company was absorbed by the Hudson's Bay Company. Eccles (1969, p. 140) explains the demise of the Company thus:

> "Eventually rising costs over the long haul to and from the northwest, declining prices for furs, the profligacy of the Nor'Westers and their resulting lack of financial reserves, drove them to the wall. In 1821, the surviving partners were glad to merge with the old foe, the Hudson's Bay Company."

Thereupon, the Hudson's Bay Company took over many of the North West Company's posts and established some additional posts of its own. One year earlier it had built Fort Frances close to the site of the former French fort of St. Pierre, two miles along the Rainy River from Rainy Lake. Fort William continued in operation, as did Rat Portage House and Osnaburgh House.

The re-orientation northwards that ensued with the ascendancy of the Hudson's Bay Company spelled the decline of the southern posts. Paul Fountain, describing Fort William in 1866, observed that "very little trade in peltry is done here" (Fountain, 1904, p.63); and that "Fort William is not worth two lines of description. There is absolutely nothing attractive about the place, or the storehouses, which seem huddled together in designed confusion." In 1878 the post was closed. Farther west, Fort

Frances' fortunes were no more prosperous: Fountain (1904, pp. 73-74) described it as a small and decaying place, by a waterfall, occupied by a trader and a half-breed labourer. In need of supplies, Fountain was unable to obtain them as the post sold nothing; all transactions being by barter. Two days later Fountain was unable to buy supplies at Rat Portage House, for the same reason.

Thus the fur trade had declined in the southern part of the region by the late 1860's. But it had opened up the territory, it had shown men settlement locations and sites, and routeways. As Bertrand (1959, pp. 1-18) observes, the River Kaministikwia was the first and last river in the southern part of the region over which the fur trade was prosecuted and both Canadian Pacific and Canadian National Railways, as well as the Trans-Canada Highway, have used its lower valley to overcome the height of land between the Lake Superior and Hudson Bay watersheds.

Moreover, the fur trade era provided history for Northwestern Ontario;a history that now glorifies the exploits of the voyageurs as they faced long-distance travel over a rugged land and under conditions of extreme privation. Fur trade society was essentially a male society and the stress on the maleness of society lingers on in present-day Northwestern Ontario; and the connections between the maleness of society and the characteristics of consumer behaviour are explored subsequently in this study.

In terms of service provision the fur trade era helped to establish the notion of exchange of goods at locations of defensive and accessibility significance. The forts and trading posts had to be self-sufficient and had to contain a wide variety of supplies. It is shown later that in present-day Northwestern Ontario the

general store seems to occupy a special status within the hierarchical system of service centres identified; and it may be argued that this special status is a reflection of the special conditions of the frontier and that, in part, it reflects the continuation of a practice originating in the fur trade era.

MINING: 1845 -

The Precambrian Shield underlies most of Northwestern Ontario and the whole of the study area. Composed mainly of granitic rocks, the Shield is diversified geologically by volcanic, sedimentary and intrusive rocks in association with which most mineral finds are located (Figure 1.5).

The history of mining in Northwestern Ontario may be dated from 1845, in which year thirty applications were made for mining locations at the head of Lake Superior (Black, 1925-27, p.116). It may be inferred that the filing of these applications stimulated government action for in 1847 two mining locations to the southwest of Thunder Bay (Stuart and Prince) were surveyed and in 1856 the Jarvis mining location was patented.

Mining started in earnest in 1868, when the Montreal Mining Company discovered silver at the tip of Thunder Cape and the Silver Islet mine was sunk. Mining at Silver Islet was fraught with difficulties: the silver vein varied in thickness, and the incursions of Lake Superior hampered operations. Finally, in 1884, as the coal supplies diminished "...the fires died out, the pumps slowed to a stop, and Lake Superior took back what had been so painfully wrested from her...", and later that same year "...a general exodus began which continued until only one family was

left..." (Scott, 1957, p.135).

Silver mining occurred also to the west of Thunder Bay in the Silver Mountain area where, by 1890, the Beaver, Rabbit and Silver Mountain silver mines were in operation, (Carthy, 1923, p.49).

Mining developments stimulated activity in two other spheres, forestry and transportation. In 1877 the Davidson sawmill, on No. 1 Island (McKellar Island) and the Graham and Horne sawmill (in Fort William) commenced operation, producing wood for mining operations; and the Thunder Bay Mining Company constructed a dock at Prince Arthur's Landing (Port Arthur) (Carthy, 1923-24, p. 44).

Silver was the metal sought and mined in the late nineteenth century but evidence of gold deposits existed. Some gold was mined at the Huronian mine (near Shebandowan) in the 1870's and some gold was produced from the vicinity of the Seine River to the east of Rainy Lake at the turn of the century (Ontario Department of Treasury and Economics, 1969, p.33). Also, according to Brown (1965, p.116), hints of gold deposits in the Red Lake area were forthcoming as early as 1872, but gold mining did not assume major importance in Northwestern Ontario until the 1920's and 1930's. In 1926 the Red Lake gold rush began with prospectors moving in by dog-team, wheeled aircraft and flying boat. The first gold mine, the Howey, came into production in 1930; and between then and the time of writing another eleven mines have operated, of which only four still operate. The rapid succession of gold finds and the large number of companies involved led to the formation of five separate settlements in the Red Lake area: the townsite of Red Lake itself, Madsen, Cochenour, McKenzie Island and Balmertown.

Contemporaneously, gold was discovered at Uchi Lake, Pickle Lake and in the Longlac-Geraldton-Beardmore area. All of the mines in these locations, except for one at Geraldton, have been closed as reserves have become exhausted and as costs have risen while the price of gold has remained fixed.

Mining for base metals on a large scale is a feature of the post World War Two period. Prospecting in the vicinity of Atikokan in the 1930's revealed an iron ore deposit of over 2,000,000,000 tons, with a life expectancy at current extraction rates of over one hundred years. To mine the ore, a twelve-mile long arm of Steep Rock Lake had to be drained and a clay cap one hundred and fifty feet thick had to be dredged off the former lake floor (Hilliard, 1953). The ore taken from the two mines at Atikokan is transported by rail to Thunder Bay ore-dock, whence it is loaded on to ore ships.

Complementing the Atikokan development has been the Manitouwadge strike. The Manitouwadge area was geologically surveyed in 1931-32, but it was not until the early 1950's that it attracted attention. Three Geraldton men, their interest in the Manitouwadge area awakened by reports of the 1931-32 survey, set in motion a chain of events that discovered a large copper-zinc-silver orebody and sparked off a staking rush that involved 10,000 claims being established over a band of territory eighty miles long by five to twenty miles wide (Brown, 1963, pp. 135-138). Prospectors either flew in from the gold mining town of Geraldton or trucked or hiked south via Caramat and Stevens. Two major mines were sunk (Geco and Wilroy), coming into operation in 1957. In association with the Community Planning Branch of the Ontario Department of Municipal

Affairs a 144 square mile area was designated as the Manitouwadge Improvement District and a townsite of that name developed within it.

The early mines of Northwestern Ontario attracted settlements which died when the mines ceased operation. Later mining operations, remote from existing settlements and transportation routes, attracted substantial settlements in terms of plant, houses and service establishments. When mining operations ran down, as at Beardmore - Geraldton - Longlac, alternative employment had to be sought, and it was found in the form of tourism and forestry. Because there is no real pattern to the distribution of mineral-bearing rocks in the study area the distribution of mining settlements in turn lacks real pattern, save that most of the major mining settlements tend to be on or near major through routes.

The irregularity of the spacing of mining towns presents special conditions in terms of service provision. If the site is isolated, then goods and services must be provided on the spot, as at Atikokan and Manitouwadge. If several mining towns develop in close proximity there is the possibility of some specialisation and reciprocal consumer travel amongst them, as at Red Lake. In time a location chosen because of its site suitability in terms of mineral deposits may come to have a degree of accessibility that encourages the initially inward-looking service establishments to cast their net wider to encompass surrounding settlements, as has happened with Geraldton in respect of Longlac, Nakina and Beardmore. Generally, mining towns have the least assured futures and present unique cases in service provision.

AGRICULTURE AND RURAL SETTLEMENT: 1857-

In 1961 only 732.4 square miles of Northwestern Ontario's 212,747 square miles was classified as farmland, and only 9.2 per cent of the population classified as rural lived on farms. Agriculture contributed only 2.4 per cent to the employment structure of Northwestern Ontario. This represents a decline from the peak of agricultural expansion in 1931 and the situation is maintained at its present level only with the help of government subsidy. Indeed governments, of different levels, have been closely associated with the agricultural development of Northwestern Ontario from a very early time.

The primary object of the Gladman-Dawson-Hind expedition of 1857 was to explore the territory between Lake Superior and Red River, to discover the best route between the two for conducting settlers to the prairies (Warkentin (ed.), 1964, p. 191). In his report to the Legislative Assembly of Canada, the geologist H. Y. Hind (a leading member of the expedition) described the land lying adjacent to the Nor'wester range (the valleys of the Rivers Kaministikwia and Slate) as promising agricultural wealth (Carthy, 1923-24, p. 49). Part of the plan for the proposed route involved settling lots on either side of the road as construction proceeded; but the route eventually selected linked Prince Arthur's landing (Port Arthur) and Shebandowan Lake, avoiding the lower valley of the Kaministikwia; and the plan to settle the road-side lots appears to have come to nothing (I.J. Dawson, 1967, pp. 47-54).

Some indication of the state of agriculture twenty years later is provided by the 1881 census for the District of Algoma (Table 1.2).

TABLE 1.2

ALGOMA, 1881: LAND OCCUPIED AND IMPROVED (in acres)

	Nipigon	Silver Islet	Prince Arthur	Fort William
Occupied	805	6,010	732	1,093
Improved	132	410	129	614
Crops	97	8	60	574
Pasture	35	402	63	34
Gardens	-	-	6	6

Source: *Census of 1881*, Table XXII.

It is difficult to determine the precise areas to which these data apply: they may apply to areas enclosed by municipal boundaries, where such boundaries existed; or, more likely, in view of the constant realignment of areas amongst different municipalities, they may apply to a general area centred on the settlement named. A range of field crops was produced, principally wheat, barley and oats, as well as limited amounts of potatoes and turnips. By the end of the century most of the geographic townships at the Lakehead had been surveyed in and settlement and clearing were proceeding apace; and a start had been made to surveying townships, concessions and lots in the Rainy River district, and in the Kenora district near Dryden and Kenora.

The story of the expansion and contraction of the agricultural frontier in Northwestern Ontario has been described elsewhere by the writer (I.G. Davies, 1968b, pp. 131-133):

> A survey report published in 1901 revealed that south of the C.P.R. track a considerable

expanse of Rainy River and Thunder Bay had neither been physically assessed nor opened up for settlement but a formal resource survey was deemed unnecessary as contemporary railway construction, it was believed, would bring natural resources to light. The results of the survey indicated that apart from some 384,000 acres of clay land in the vicinity of Dryden the agricultural potential of the area north of C.P.R. track was limited to discontinuous patches small in total extent.

Government interest in developing the northern parts of Ontario was evidenced by the Northern and Northwestern Ontario Development Act of 1912 in which provisions were made for financial advances or loans to settlers willing to enter areas, the potential of which was not fully known.

Between 1913 and 1931 the area of land assessed as farmland increased from 779,000 acres, 7.8% of which was cleared, to 1,021,000 acres of which 12.8% was cleared. More striking than the gross growth of farmland was an increase in the intensity of land use. For example, in 1913 field crops accounted for only some 36,000 acres but by 1931 some 93,400 acres bore field crops and the total number of cattle had nearly doubled, rising from the 1913 figure of 8,628 to 14,534 by 1931. According to Lower, by 1929 eighty-six Northwestern Ontario townships were open for occupancy but even in the most heavily settled townships land suitable for settlement still remained to be taken up. Concern over the pace of colonization and the nature of development of existing farms led to the formation of the Northern Development Department to promote agriculture and settlement in the northern parts of the province. Legislation in the Depression Years of the early 1930's revealed a continuing concern to develop northern agriculture per se with financial support provided by the Northern Ontario Appropriation Acts. However the Relief Land Settlement Act of 1933 was designed to alleviate the plight of the urban unemployed by encouraging and subsidising a back-to-the-land movement. Abandoned farmland was resettled and some existing farms were subdivided into smaller units with the aim of providing the unemployed with the opportunity of at least feeding themselves rather than developing

> viable commercial farms. Thus a class of pseudo-farmers was introduced on to land without capital and real knowledge of farming usually in units too small to allow capital formation and subsequent farm enlargement and specialisation [*sic*]. Over much of the period since 1945 decrease of farmland represents the termination of operation of these units. Created as subsistence units rather than as commercial farms they were included in the 1951 census returns, their demise and absence from the 1961 census figures being utilised as criteria of the running-down of the agricultural economy. A post World War II attempt to introduce a different body of men onto Northwestern Ontario land can only be described as slightly more successful than previous efforts in the same direction. Under the Veterans' Land Act 420 carefully selected and trained ex-servicemen have taken up land subsequent to 1945. Despite the continuing interest and technical and financial assistance of the agricultural branch of the Canadian Department of Veterans' Affairs by early 1968 only 97 of the farms established under its aegis remained. Those remaining are expected to continue in farming and expand their operations.

Thus agriculture in Northwestern Ontario has experienced two main phases: a phase of expansion when the development of agriculture was linked with the settling of land and when the classic image of the immigrant gained force, Sefton's "...peasant in a sheepskin coat, with a fat wife and ten children" (Lower, in Bladen (ed.), 1962, p.55); and a phase of contraction during which the commercial aspects of farming have been stressed. In this latter phase smaller farms have ceased operation and larger units have been assembled by farm amalgamation; there has been increasing mechanisation, partly linked to difficulties in obtaining hired labour; and the mixed farm has gradually been replaced by specialised units. Over both phases the farmer has

had to contend with a limiting climate, the principal difficulty of which is the short growing season and the lateness of its start compared with the Southern Ontario season, for example. The three main agricultural areas tend to be oriented towards supplying the needs of settlements close by; and they meet the demand for milk, but not for meat or vegetables (I.G. Davies, 1968b, pp.133-153).

As farms go out of production, the farmhouses, particularly those located near settlements such as Fort Frances, Thunder Bay and Dryden, continue to house their former or new occupants engaged in non-agricultural pursuits in the urban areas. Thus decline in the farming population is not matched by decline in the rural population.

The change in the composition of the rural population, however, has tended to affect the pattern of service provision and consumer travel behaviour in the rural areas. Firstly, the daily commuting from rural dwelling to major service centre and place of work has tended to increase the patronage of service establishments in the major service centres at the expense of isolated, single stores and small service centres in the rural areas. In places this has led to the demise of the rural service points and centres so that the agricultural rural population also is forced to rely more heavily on the major service centres. The process has been facilitated by improvements in road surfaces and by the almost universal automobile ownership in rural areas. It is shown subsequently (Chapter 4) how small service centres and service points are used only for groceries and meat; how small service centres are almost non-existent in the vicinity of major centres (such as Port Arthur and Fort William) and how they have a slightly more

important service role in an area devoid of a major service centre and where the dominant service centre is not optimally located in terms of the rural population (Rainy River). Further, there is ample evidence of smaller service centres which could provide a good or service being bypassed on shopping trips in favour of larger service centres.

FORESTRY AND ASSOCIATED INDUSTRIES: 1877-

The first impetus for commercial logging in Northwestern Ontario was provided by the need to supply hardwoods for building, and this need was partially met from the mixed forest area in the south of the region. A second impetus was provided by mining ventures; and as there was no distinct pattern to mining developments, and as mining booms came and went, so the location of logging areas and saw mills varied.

But by far the greatest impetus for commercial forestry was provided by the establishment of pulp and paper mills within Northwestern Ontario to supply external markets, principally that of the United States. J.L. Robinson (1969, p. 51) has summarised the external forces behind the location of pulp and paper mills in the Canadian Shield, including Northwestern Ontario:

> ...the social factor of increased literacy, combined with technical improvements in printing, came at a time when the United States was beginning to fear the depletion of its softwoods and when Ontario and later other provinces prohibited the export of pulpwood from Crown lands...the United States lowered and then removed the tariff on imported newsprint. As a result both American and Canadian capital

> decided that it was to their advantage to build mills at the source of supply of conifers and to export newsprint to the United States.

Only three, widely-separated mills were established in Northwestern Ontario before the first World War (Dryden and Fort William, 1911; and Fort Frances, 1914). There are no long rivers in the southern part of Northwestern Ontario, much of which is south of the height of land. By locating on lake shores, however, these three mills were able to draw supplies of pulpwood from a wide area by driving logs down a myriad of short rivers draining into the lakes; and on the lakes the logs could readily be assembled and rafted to the mills. Thus the Fort William mill is on Lake Superior, the Dryden mill on Lake Wabigoon, and the Fort Frances mill on Rainy Lake. Moreover, each of these mills is located on a railway line along which pulp and newsprint could be exported; and, in addition, the Fort William mill could export its products by lake steamer (Figure 1.6).

This locational pattern persisted in the inter-war period, with the additional mills established in Port Arthur and Fort William intensifying the concentration at the Lakehead and with mills at Nipigon (1923) and Kenora (1924) adding to the scattered pattern. The latter two locations repeated the characteristics of the pre-1914 mills: the Kenora mill drawing on wood rafted over the Lake of the Woods, and the Nipigon mill receiving wood via Lake Nipigon and its tributaries and the Nipigon River. Moreover, both Kenora and Nipigon are located on the CPR line. In 1952 Fraser (p. 323) reported that the Nipigon mill had operated only spasmodically since its establishment; and at present it has been replaced by a plywood

factory and a pulp mill has been established in Red Rock.

The Red Rock mill, along with those at Terrace Bay and Marathon, represents a slight departure from earlier mills in that it constitutes the main economic base of a completely planned settlement.

The north shore of Lake Superior was being logged in the 1930's with the pulpwood being floated down the lake's tributaries, assembled in Lake Superior and shipped to the United States. Foster (1951) described the logging practice as "cut and get out". Woodruff (1952, p. 65) reports that cutting in the eastern section of the north shore of Lake Superior began in the Pic River area in 1936; and Graham (1948, pp. 24-25) reports that in the 1930's logs from the shores of Long Lake were driven down the Aguasabon River, rafted at its mouth, and towed to the Slate Islands where they were loaded on to barges and transported to the United States. With the granting of three great timber licences which completely used up the Lake Superior north shore and with the heavy investment in plant at millsites and townsites, improved logging practices -- sustained-yield or ration-cutting -- have been introduced.

The operation of these mills, and the others previously discussed, affects the settlement pattern over a wide area by either maintaining existing settlements or by creating new ones in connection with woodlands operations. Thus Beardmore, once a mining centre, is now a distribution centre supplying the bush camps of the Red Rock mill, and Jellicoe is a base for the mill's bush workers; Longlac is the headquarters of the Terrace Bay mill's woodlands' division although a straight-line distance of seventy-five miles separates the two settlements; and Stevens is the

headquarters of the Marathon mill's woodlands' division (Woodruff, 1952, pp. 43, 48 and 68).

Thus the locations of the settlements based primarily or partly on pulp and paper production were chosen with the assembly of raw material and distribution of the finished product in mind. In some cases, Kenora and Fort Frances, for example, these locations accorded with locations chosen for forts and trading posts during the fur trade era. In other cases, new locations (such as Dryden and Red Rock), or former railway stops, such as Black (Terrace Bay) or Peninsula (Marathon), were selected. Forestry and pulp and paper manufacture have created new settlements or strengthened the economic bases of older settlements.

The writer has been unable to discover the conditions under which goods and services were provided for workers at the early mills such as Fort Frances, Dryden, Kenora and Nipigon. It may have been that the pulp and paper companies initially operated stores that were subsequently taken over or replaced by private entrepreneurs. In the later mill towns such as Red Rock, Terrace Bay and Marathon, however, the companies were active in providing goods and services for their workers. On the retail side, planned shopping centres were designed as integral components of the townsites and premises were let to private entrepreneurs. On the service side, facilities were provided for medical care particularly, and the very provision of these facilities has perhaps encouraged doctors and dentists to locate in settlements they might otherwise have found unattractive. The traditional picture of single-industry towns involves the residents in almost exclusive patronage of company-owned and company-operated facilities and the degree to which residents

patronise facilities in their home-towns, under different organisational conditions, is shown subsequently (Chapter 5).

TRANSPORTATION

In an area as large as Northwestern Ontario it is to be expected that transportation will itself form an important sector of the economy, particularly when the location of the region between eastern and western Canada is recalled. Transportation accounts for 13.12 per cent of the region's labour force, and the region's connecting role has been suggested earlier: in terms of the fur trade the Kaministikwia River is described by Bertrand as "The Highway of Destiny"; the Dawson Road was built primarily to transport settlers to the Red River area; and the construction of the CPR was one of the prices of British Columbia entering Confederation.

Northwestern Ontario at present possesses all main forms of transportation for people and goods. The most continuous inter-settlement links are provided by roads and railways which also provide links to east, west, and south. Rail and water transport experience their most impressive junction at the Lakehead, where giant grain elevators, a massive ore-dock and a modern seaway terminal crowd the waterfront. Hard-surfaced and gravel runways and grass landing-strips complement water and ice in providing the bases of air transport, principally to points outwith the region.

An evolutionary approach to transportation in Northwestern Ontario is important to the present study from two points of view: transportation developments and advances have provided initial and

continuing economic bases for some settlements and have provided only temporary bases for others; and, secondly, as most of the consumer travel subsequently analysed in this study comprises automobile transportation, the recent construction of hard-surfaced roads, or any roads at all, means that present travel patterns are of recent origin.

For about two hundred years travel overland in Northwestern Ontario was slow and difficult, particularly in summer, and rivers and lakes offered the easiest means of penetrating the territory. Fountain (1904, pp. 50-62) offers comparative information on travel in 1865; it took between seven and twelve days to paddle round the north shore of Lake Superior, averaging about fifty miles per day and keeping close in to the shore; rates of travel by river and inland lake varied with the number and severity of portages. Winter snow and ice negated the use of the canoe but European travellers could average twenty to thirty miles per day on snowshoes, while Indians could average forty (Fountain, 1904, p. 57).

The first major road built in Northwestern Ontario was that between Prince Arthur's Landing and Shebandowan Lake (1868-1872), part of the Dawson route to the Red River country. A rough surface of stones and wood meant that travellers endured a slow and harrowing journey (Berton, 1970, p.58).

This road was soon superseded as a route to the west by the CPR line; which also allowed the flow of grain eastwards. Grain first arrived in bulk at the Lakehead in 1872, when it was stored in sheds at West Fort William and loaded on to small wooden steamers via wheelbarrows (P. McKellar, 1916, p.17). The first grain elevators at the Lakehead were rapidly constructed (Fort William, 1883;

and Port Arthur, 1884). Although the early elevators were small, having storage capacities of about one quarter of a million bushels, concrete elevators were constructed from the turn of the century until by 1930 a total of thirty elevators (fifteen in each of Port Arthur and Fort William) lined the waterfront, with a total capacity of 92,680,000 bushels (Miller, 1935, p. 524). More recent additions to the harbour facilities have included a specially designed ore-dock, which facilitates the annual movement of about 3,000,000 long tons of iron ore from Steep Rock; and a new cargo terminal, between the Port Arthur and Fort William grain elevators and close to nine trucking terminals (Millar and Van Allen, 1962, pp. 175-179; Malinoski, 1962, pp. 97-81). The shipping season at the Lakehead opens usually in mid-April and closes about mid-December; and for the remaining four months Thunder Bay is ice-bound. During the shipping season over 2,000 vessels call at the port, which handles over fourteen million tons of cargo and is the third most important port in Canada.

Thus the junction of several forms of transportation and the attendant storage and handling of cargo have provided an important economic base for the cities of Port Arthur and Fort William.

The railway tracks, once lined with small settlements concerned with fueling, watering and generally servicing trains, still provide the economic underpinning for some of the region's settlements. Schreiber, Rainy River, Sioux Lookout, Nakina and Ignace are all divisional points where train-crews live and trains are serviced.

While the railway early served to transport goods and people through the region, it also performed local services. Orr, writing of the Lakehead area, (1970, p. 28),reports that in the early part of this century, settlers, faced with poor road development,

relied on rail transport to cover less than twenty-miles, utilising small stations such as Murillo, Baird, Neebing, Jelly and Rosslyn to board trains for the Lakehead cities (Figure 4.28).

The construction of hard-surfaced roads for long-distance travel may be dated at 1917 when the Fort William-Duluth Highway (61) was opened. The Lakehead-Kenora section of the Trans-Canada Highway was officially opened in 1934 and travel eastwards by road was facilitated with the completion by 1937 of the Port Arthur-Schreiber section of the Trans-Canada. Highway 11 between Port Arthur and Geraldton was not completed until 1948 and the north shore Trans-Canada road route was completed in the same year with the building of the Marathon-Shreiber section. The last major link was completed in 1966 when the one hundred mile gravel road between Atikokan and Fort Frances was hard-surfaced.

Changes in road surface at the local level have been quantified by Orr (1970) and are summarised in Table 1.3.

TABLE 1.3

LAKEHEAD AREA: CHANGES IN ROAD SURFACE (in miles)

	1915	1941	1951
1st class gravel	100	150	250
3rd class gravel	200	200	30
Under construction	100	-	-
Trail	50	30	-
1st class paved	-	75	150
Total	450	455	430

Source: Orr, 1970, pp. 32, 41 and 48.

Thus, while there is no way of ascertaining whether first class gravel roads were judged on the same criteria on each occasion, the nearly constant road mileage at each stage compared with the increasing proportion of paved road is striking.

Now, over the first class paved roads, the maximum permitted automobile speed of sixty miles per hour can easily be held for long distances, so that Kenora, 290 road miles from Port Arthur, can be reached in five hours driving under favourable weather conditions. Driving conditions in winter vary. During blizzards visibility is poor and driving is slow or impossible. Temperature and precipitation combine to render road surfaces dangerous: Wilkie (1969) in a study of Port Arthur and Fort William, found two clusters of accidents in association with low temperature, at the freeze-thaw mark and between zero and $-10^{\circ}F$. Whether or not actually dangerous driving conditions or imagined dangerous driving conditions influence consumer travel behaviour between settlements is an object of investigation in this study.

Air transportation, which has been important in the initial stages of settlements such as Red Lake and Manitouwadge, is more a means of movement between the region and other regions than a means of travel within it. However, it is important in the development of tourism, as have been the roads.

Transportation forms and routes, therefore, have increased the proximity of settlements and have constituted the economic bases of settlements.

Road, rail, water and air transportation routes reach a remarkable convergence at Thunder Bay, and transportation and storage constitute a significant sector of the city's economic base.

Wholesaling activities (specifically outwith the terms of reference of this study) tend to develop at break-of-bulk points and Thunder Bay has developed as the only wholesaling centre of note in Northwestern Ontario. In an earlier study the writer examined marketing mechanisms for agricultural products and food in Northwestern Ontario (I.G. Davies, 1968a). Generally, retail outlets to the west of a line between Atikokan and Ignace were supplied by Winnipeg based wholesalers and those to the east of it by Thunder Bay-based wholesalers. At that time very little of the food consumed within Northwestern Ontario was produced in the region's agricultural areas: meat came from Brandon and Winnipeg slaughterhouses; fruit and vegetables from Southern Ontario and California; but most of the milk consumed was produced locally.

Schreiber and Nakina, on the other hand, present examples of settlements based on more limited transportation forms and convergence. Schreiber, a CPR divisional point, has a number of hotels and boarding houses close to the railway line and easily accessible to train-crews between shifts. These simple and unpretentious structures contrast strongly with the more luxuriously appointed motels lining the Trans-Canada Highway which passes just to the north of Scheiber. Nakina is heavily dependent on the CNR, as seen in the storm of protest at plans for a "run-through". But apart from hunters the settlement receives few other visitors and service provision is closely adjusted to the settlement's resident population.

TOURISM: 1867-

In an area of light development man can still feel himself

to be an intruder in the natural landscape; and this is the case with vast stretches of Northwestern Ontario. A matrix of elements combine to attract the tourist: the still solitude of the northern forest; the warm waters of inland lakes and the sweeping views of the cold waters of Lake Superior; the abundance of fish and game; contorted rock formations; and pleasant summers and endurable winters. The tourist comes to drive round and look, to boat, to swim, to fish, to hunt, and to ski. Tourism employs about ten per cent of Northwestern Ontario's work force.

The tourist potential of Northwestern Ontario, or at least those parts of it comfortably accessible, seems to have been recognised early. Some excerpts from an advertisement promoting an excursion on the steamer *Algoma* (from Collingwood to Fort William and back) which appeared in Toronto's *The Daily Globe* (1867, July 1st, p.3) read as follows:

> The trip to Fort William...presents to the tourist scenery which for grandeur and beauty is unequalled on this continent. The magnificant view of Pic Island and Thunder Cape, 1500 feet high, would alone reward the tourist...The pure and backing air of Lake Superior is unequalled. It is said by medical men that the trip to Fort William is more invigorating to the invalid than any other trip that can be taken on this Continent.

Movement of tourists into and through Northwestern Ontario affects the settlement pattern in a number of ways. The summer motorist creates a demand for food, accommodation and petrol, a demand most often satisfied in main settlements but sometimes met by tourist-oriented settlements or isolated service points. For example, servicing tourists constitutes an important economic

activity in Kenora, Keewatin, Dryden, Sioux Lookout, Beardmore, Port Arthur and Fort William; and settlements such as Vermilion Bay, Nestor Falls, and Sioux Narrows are entirely dependent on tourism (Ontario Department of Treasury and Economics, 1969, p. 27; and writer's field survey, 1968). On the other hand, the serious fishermen and hunters base themselves at outfitters' camps, far from road and rail transport and accessible only by air. This creates a fairly dense pattern of dispersed settlement, rarely shown on maps and not readily observable (Ontario Department of Treasury and Economics, 1970, p. 25). These camps in turn have to obtain supplies and it is thought that they do utilise existing service centres, although it is beyond the scope and capacity of this study to investigate this aspect of consumer behaviour.

POPULATION GROWTH AND SETTLEMENT DEVELOPMENT

In 1966, 223,484 persons (3 per cent of the Ontario population) lived in the 202,777 square miles of Northwestern Ontario (58.9 per cent of the province's land area). Most of them lived in the three territorial districts in the southern part of the region: Thunder Bay, Rainy River and Kenora[1]. The Patricia Portion of the District of Kenora contained only 14,230 people (1966), scattered in small, remote communities such as trading posts and Indian reservations. Of the territorial districts' population of 209,254, about sixty per cent lived in Thunder Bay Territorial

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[1] The territorial district is division of the province used primarily for presenting statistical data; as it has no forms of government associated with it, it is not really analogous to the county of Southern Ontario.

District (TD) and approximately half were concentrated at the Canadian Lakehead, in the cities of Port Arthur and Fort William and in adjacent municipalities. The early location of settlement in Northwestern Ontario, on the shores of Thunder Bay and by the banks of the River Kaministikwia, has experienced a continuing growth of population; and it is only comparatively recently that the southern part of the region has been infilled with settlements. In the process the ratio of Indians to the total population has declined. Despite a higher Indian birthrate, a higher Indian deathrate and non-Indian immigration have caused the white population to grow at a faster rate.

The present arrangement of Northwestern Ontario into territorial districts had evolved by 1901, and in that year the total population amounted to 28,156. The region experienced its most rapid rate of population growth of the twentieth century in the first decade (Figure 1.7) when Canada generally was experiencing a period of vigourous immigration; and it experienced its slowest rate of population growth in the following decade, a decade that encompassed the first World War. Thereafter, a fairly steady rate of decennial increase has been maintained in the region as a whole, though the three territorial districts have shared unequally in the increase. In 1901 the Thunder Bay TD population (11,219) slightly exceeded that of the Kenora TD, while the latter in turn was approximately forty per cent higher than that of Rainy River TD. This rank-ordering of population totals has corresponded to the rank-ordering of rates of increase, so that the original population differences amongst the three districts have become more pronounced (Figure 1.7).

Of the Thunder Bay TD population of 11,219 (1901), over half lived in the towns of Port Arthur and Fort William. No other settlement in the district reached 1,000 persons, the next largest being Nipigon (940) and Schreiber (510). The dramatic increase in population experienced by the district over the first decade (almost fourfold, to 39,496) may be ascribed largely to the rapid growth of the Lakehead cities' populations, Fort William's increasing fivefold and Port Arthur's threefold. On the other hand, whereas Schreiber's population doubled, Nipigon's halved. Thereafter the Lakehead cities maintained regular rates of population increase, to reach totals of 48,208 (Fort William) and 48,340 (Port Arthur) by 1966. The settlement pattern filled out in the 1930's with the development of Beardmore, Geraldton and Longlac in association with gold mining; and in the 1940's with the development of the pulp and paper-based settlements of Red Rock, Terrace Bay and Marathon. Although gold mining declined in the 1950's and 1960's, the gold mining settlements were given new leases of life as they became bases for woods-operations and as they developed service roles. Also in the 1950's the isolated mining settlement of Manitouwadge added a far eastern component to the settlement map.

The reservation Indian population formed ten per cent of the Thunder Bay TD population in 1901 and had declined to less than two per cent by 1966. In the Kenora TD, however, reservation Indians accounted for nearly half the 1901 population, when Kenora with 5,000 people was the only settlement of note. By 1911 Dryden and Keewatin had been founded; and, whereas the population of the former had increased fourfold by 1966 (6,732), that of the latter had not even doubled. Keewatin (2,089) has been overshadowed by

the growth of Kenora (11,295 by 1966), always the largest settlement in the Kenora TD. Northern components were added to the settlement pattern with the development of the CNR divisional point of Sioux Lookout, in the second decade, and the growth of Hudson and the settlements of the Red Lake area in the 1930's.

In 1901 the Rainy River TD population totalled only 6,000, of which reservation Indians made up one fifth. The non-Indian population was located mainly in the rural townships and in the nascent towns of Fort Frances and Rainy River. Both of these settlements possessed populations slightly in excess of 1,000 by the 1911 census, by which time they had incorporated as towns. The establishment of a pulp and paper mill in Fort Frances, in 1914, occasioned such a population increase that the population had grown to 3,109 by 1921. Fort Frances' 1921 population had trebled by 1966 but Rainy River, on the other hand, has recorded slight population losses in every census year since 1901, declining to 1,149 by 1966.

By 1966 twenty municipalities, which could be described as being predominantly urban in nature, had developed in Northwestern Ontario (Table 1.4), but they are composed of four different types of municipal status: two definitely urban (city and town), one usually thought of as rural (township) and one transitional (improvement district).

Municipal status depends to a great extent on population. The minimum population a village or town requires to incorporate as a city is 15,000 and the minimum required by a village to incorporate as a town is 2,000. To incorporate as a township (usually a rural municipality) a geographic township requires a population of

TABLE 1.4

NORTHWESTERN ONTARIO: LARGER SETTLEMENTS' MUNICIPAL STATUS AND POPULATION

Settlement	Status	Pop. 1966	Adjusted Pop. 1968
Port Arthur	City	48,340	
Fort William	City	48,208	
Kenora	Town	11,295	
Fort Frances	Town	9,524	
Dryden	Town	6,732	
Atikokan	Township	6,386	6,240
Geraldton	Town	3,658	
Manitouwadge	Improvement District	3,132	2,983
Nipigon	Township	2,702	2,199
Sioux Lookout	Town	2,667	
Marathon	Improvement District	2,628	2,532
Red Lake	Township	2,476	2,381
Schreiber	Township	2,188	
Keewatin	Town	2,089	
Red Rock	Improvement District	1,980	1,314
Terrace Bay	Township	1,966	1,896
Balmertown	Improvement District	1,859	1,738
Longlac	Township	1,322	1,315
Rainy River	Town	1,149	
Beardmore	Improvement District	1,060	798*

* Based on 1968 special tabulation : adjusted population is that comprising the settlement nucleation within the municipality.

Source: DBS: Census of Canada, 1966;
Ontario Department of Treasury and Economics, 1969, Tables 2.b, 2.c, and 2.d.

1,000. An Improvement District is a locality of at least fifty people with a transitional municipal organisation consisting of a three-man board of trustees, appointed by the Ontario Lieutenant-Governor, working with the Ontario Department of Municipal Affairs in managing the affairs of the locality. Improvement Districts may incorporate as villages, townships or towns, after three years and once they reach the 500, 1,000 or 2,000 population levels respectively, (Rowat, 1955, pp. 1-20; *Revised Statutes of Ontario,* 1960, c 249). Although application may be made for incorporation -- a device by which a community assumes its own legal responsibilities -- at the specified population level, it need not be made; moreover, the Ontario Municipal Board may recommend the granting of a particular municipal status on grounds other than those of population alone.

Census figures for the populations of towns and cities apply to those people living within municipal boundaries and this may understate the geographic population of a settlement where there has been significant suburbanisation of adjacent rural municipalities, as with Fort William (city) and Neebing (rural township), or Kenora (town) and Jaffray (township). A different problem, that of overstating the urban population, may occur when sizeable settlement nucleations are part of an areally wider municipality such as a township or improvement district. In some instances the difference is slight: for example, the Atikokan Township population (1966) was 6,386, whereas a special tabulation performed by the Ontario Regional Development Branch (1968) lists the townsite population as 6,240; and the difference could have been produced by time-lag. In other instances the difference may be more substantial: for example, Nipigon Township's population (1966) was 2,702, compared

with tabulated townsite population (1968) of 2,199 -- 503 of a difference!

These differences raise problems in any attempt to rank-order and group the larger settlements by population. In addition to the settlements listed in Table 1.4, there are many settlements of under 1,000 people (unincorporated places) found in municipally organised territory or in unorganised territory. These places, the populations of which are listed in Appendix I, are classified at under 1,000 in population and shown in Figure 1.8. The settlements of over 1,000 population have been subjectively grouped into four size-classes, based on adjusted population figures when these are available, and are also shown in Figure 1.8.

The morphologies of the settlements within which the population resides have a bearing, potentially, on inter-settlement movement. W.K.D. Davies (1968, pp. 91-110) has shown how increases or decreases in demand for goods and services, originating from either within or outwith the settlements or both, can affect the morphology of settlements. Equally, the morphology of settlements may affect the patronage decision of those consumers who consider factors such as inter-establishment accessibility and establishment appearance as well as intrinsic service factors such as comparative prices, array of choice and quality of service.

The frontier nature of Northwestern Ontario is described earlier in this chapter and some of the major settlements of Northwestern Ontario reflect frontier conditions in their morphologies particularly in the condition of the buildings devoted to service provision, conditions such as peeling paint, rotten wood, cracked bricks, pipes and gutters.

Only Port Arthur and Fort William could be described as possessing well-developed central business districts. The writer carried out a survey of the downtown areas of both cities in the summer of 1969 and discovered that a full array of professional services, financial and retail establishments was present in both; moreover, that the central business districts of both cities were comparable in areal extent, both encompassing about six city blocks when the Murphy-Vance Central Business District indices were applied (Murphy and Vance, 1954, pp. 189-222). Although the grid-iron pattern of streets imposes a semblance of order on the downtown areas, a number of the commercial premises, particularly those in the transition zone, show signs of decay; and to this visual effect is added a tangle of overhead wires and a profusion of garish signs screaming out, as it were, at passing motorists. Traffic congestion is severe, partly because of a shortage of off-street parking, partly because much through-traffic enters the downtown area, and partly because of a paucity of rear-establishment facilities for commercial vehicles in the process of unloading. A major cause of traffic congestion is automobiles circling blocks seeking parking facilities close to the shoppers' destinations. Surveys carried out by the writer suggest that downtown shoppers are unwilling to walk for much more than two city blocks. In Port Arthur, a common reason given is the exertion of walking uphill (Port Arthur is often called the hill city); and in both cities the cold and snow of winter, and laziness, are also given as reasons. In Port Arthur, the development of a "skid-row" in one section of the downtown has made it an undesirable shopping area for most visitors to the downtown. In a quest for space at lower land prices extensive

users of land, such as automobile dealers, have located on a flat strip between the two built-up areas but within the municipal boundaries of Port Arthur.[1]

Central functions in the other settlements have tended to colonise single streets. In Fort Frances and Kenora these streets are also the main through-town routes; while at Nipigon, Schreiber and Geraldton main highways bypass the settlements. At Nipigon the business section, as it is signposted, occupies one side of an open space devoted to railway tracks and sidings; and highway-oriented service establishments, such as petrol stations, cafes and motels have either gravitated to, or have been established on, the main highway. Service establishments, in business sections and on highways, tend to be strung-out, in poor physical condition, and to present a generally unattractive picture.

Two settlements stand out in contrast to these general observations: Terrace Bay and Manitouwadge. The townsites of both were fully planned, with the companies working in close co-operation with the Ontario Department of Municipal Affairs. One aspect of the planning has been carefully-designed shopping areas. At Terrace Bay a shopping mall with covered walkways and rear-access facilities for commercial vehicles is occupied by commercial enterprises which own their own land in the townsite. At Manitouwadge a compact group of service establishments flank a large parking space. In both cases the shopping areas are functionally and visually pleasing to the

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[1] Two large shopping plazas, one in McIntyre Township and the other in Fort William, which have diverted trade from the cities' downtown areas, were not functioning when the writer conducted his surveys in 1968.

extent that they should not repel the residents of the respective townsites. Manitouwadge's location makes it unlikely that it attracts a clientele from outside, but Terrace Bay's location holds out the possibility of an extra-Terrace Bay clientele in addition to summer tourists.

One other aspect of the role of the companies requires examination, their role in influencing the nature and amount of service provision, particularly in the realm of professional services.

Life in small, isolated communities on the frontier does not appear to be attractive to those in the professions, unless special inducements are offered. The dearth of lawyers in the company towns and former company towns reflects as much distaste for life in them, on the part of the legal profession, as it does the lack of work occasioned by the company providing legal or semi-legal services for its employees. On the other hand both Terrace Bay and Marathon, for example, appear to have little difficulty in attracting doctors and dentists; in contrast to Schreiber, for example. At Marathon the hospital is company-built and-operated but, while the doctors there are in private practice, they were allowed to choose the most up-to-date medical equipment for the hospital (Foster, 1951). Similarly, the hospital at Terrace Bay was built, and is operated, by company-provided funds. Companies can influence service provision in other fields. Kimberly-Clark, for example, will match any amounts raised by Terrace Bay residents for recreational facilities, such as a community hall; and it is thought that the same company heavily subsidises the Terrace Bay Hotel, one of the few remaining properties on the townsite still owned by the company. Equally, when the Improvement District of Manitouwadge needed to add

to its high school in 1963, Geco Mines paid for the extension ($300,000), so that the residents did not have to submit to an extra levy (Brown, 1963, p. 143).

These specific examples point up a general characteristic relevant to the present investigation of service provision and consumer behaviour on the frontier. On the one hand thresholds justifying the provision of a good or service may exist, but the good or service may not be provided and the consumer has either to go without, travel excessive distances or devise an alternative means of consumption, such as catalogues. As far as retailing goes, there is a shortage of investment capital for the small entrepreneur: the individual or banks which might loan capital are unwilling to risk it in setting up a business in small settlements, the economic future of which is uncertain. In this, lending institutions and businessmen are more mindful of the boom and bust conditions characterising past settlement of the frontier, for now government will rarely allow a settlement to die without strenuous activity to provide alternative economic underpinnings. But the image of the past frontier rather than the reality of the present frontier looms largest in the decision-making process. In the realm of professional services the situation is different. Highly qualified professionals tend not to live on the frontier, unless they have a particular emotional tie with a place or wish to take advantage of hunting and fishing. Much of their training and education has involved sophisticated methods, in sophisticated atmospheres and in contact with people of frames of mind similar to their own. They do not readily become the single doctor, dentist or lawyer in a small town.

On the other hand, companies which have committed considerable

financial input in plant and skilled labour have a real stake in permanence of their undertakings, in the stability of their labour forces and in the cohesion of communities. Thus they are prepared to underwrite many goods and services for which a threshold is not present and to provide facilities and conditions to induce entry of professionals who would not otherwise reside on the frontier.

Thus on the frontier simple relationships between consumer threshold and provision of a good or service will not necessarily hold true. It is to be expected that consumption will be low in some areas and that services will be provided where least expected, and that excessive distances will be travelled and that substitutes for travel will be encountered.

Again, it is a moot point that those living on the frontier tend to shrug off distance, accommodating their image of themselves as frontier residents to their images of the area's past and present frontier character by showing willingness, even eagerness, to travel sometimes quite unnecessarily long distances for goods and services. Providers of services, perceiving this, cannot be blamed for aiming at maximum aggregation of service rather than maximum dispersal.

Evidence of consumer satisfaction with service provision is contradictory. A Northwestern Ontario Development Council survey (1969) revealed dissatisfaction with the way in which professional services and the widest array of retail items were concentrated in Thunder Bay. But the writer's out-migration study, carried out in conjunction with the present investigation, did not reveal any significant movement within the area or out of the area occasioned by dissatisfaction with type or level of good and service provision.

It is later shown that Northwestern Ontario residents do

travel considerable distances to obtain goods and services. It may be thought that this reflects, or is allied to, the travelling of similar distances to work place. This is not the case, for over eighty per cent of those sampled lived within fifteen minutes travelling time of their place of employment. Equally it may be that repetition of the same social contacts in small, isolated communities induces a readiness to seize on the need for goods and services as a justification for a longer trip than is necessary, to provide an alternative social experience.

PORT ARTHUR - FORT WILLIAM

No account of population growth and settlement development in Northwestern Ontario would be complete without detailed examination of the origins and development of the twin cities of Port Arthur and Fort William and the origins and maintenance of civic rivalries between them. Nor is such an account merely historical detail, for it does much to explain duplication of service establishments at the Canadian Lakehead and from such an account some explanations of consumer behaviour may be inferred.

In the early part of the nineteenth century, when the North West Company was using Fort William as its headquarters, a wharf was constructed at the mouth of the Kaministikwia for loading furs bound for Montreal and for unloading merchandise bound westwards (Wallace, 1949, p. 17). As relations between the North West Company and the Hudson's Bay Company were strained, it is thought that the latter utilised a point on the shoreline of Thunder Bay, further to the northeast, to supply and receive furs from their posts in the

area; and it is thought that this point was then known as The Station. With the absorption of the North West Company by the Hudson's Bay Company in 1821 the wharf on the banks of the Kaministikwia seems to have been the only one used.

In 1857, by which time the Hudson's Bay Company's Fort William had declined, the Gladman-Dawson-Hind expedition established its base at The Station; and a townsite of five hundred and thirty four acres was surveyed, with lots being put up for auction; and the first house was built. One year later a mail depot was established, at the foot of what is now Arthur Street in present Port Arthur, and a road was built from there to Dog Lake (Bertrand, 1959, p. 177). In 1860 a government townsite (later known as The Plot) was surveyed near Fort William; but as the Dawson road struck out from The Station, it was the latter which received most immediate attention. Work on the Dawson road commenced in 1868, and a wharf was built where the road abutted on the shore, and government supplies for road building and private supplies for the store of pioneer merchant Thomas Marks were unloaded there. By 1870 the Dawson road was only partially finished; but Garnet Wolseley (who renamed The Station as Prince Arthur's Landing) and his troops travelled over it on their way to quell the Riel rebellion in the Red River country. Despite the troops' attentions, the road required rebuilding and it did not receive its first consignment of settlers travelling westwards until 1872. Ten thousand immigrants had passed over the route by 1873, setting out from Prince Arthur's Landing; but the building of a railway from Duluth to Moorhead (in the Red River country) provided immigrants with an easier route, and those using the Dawson route had died to a trickle by the late 1870's when the

Canadian government abandoned it (Berton, 1970, pp. 53-58).

Strained relations between the inhabitants of The Plot and The Landing developed in 1874 over the Thunder Bay terminus of the CPR line between Fort Garry and Lake Superior (Arthur, 1968, pp. 1-18; Berton, 1970, pp. 233-239). Earlier in that year the inhabitants of the two communities had joined forces to wrest the terminus away from Nipigon, which had been selected by government engineers on grounds of topographical suitability and on the evidence of an American ship captain who, in the spring of 1873, had been unable to penetrate an ice-choked Thunder Bay but who had managed to enter an ice-free Nipigon Bay (P. McKellar, 1911-1912, pp. 25-26). Both the Nipigon and Thunder Bay claimants for the terminus issued pamphlets stressing the merits of their respective bays and sites and, whether impressed with the Thunder Bay evidence or not, the government decided in favour of Thunder Bay. P. McKellar (1911-1912, p. 26) holds that the Nipigon claims were shown to be fraudulent; but as McKellar was a leading proponent of Thunder Bay, his views may have been prejudiced.

Having succeeded in attracting the terminus to Thunder Bay, the two communities then vied with each other for it. The rivalry was most vociferously expressed in the communities' handwritten newspapers (Fort William's *Perambulator* and The Landing's *Thunderbolt*, wherein each community praised itself (and predicted doom for the other, as a result of terminus-location). Until 1875, when building of the CPR line from Fort William commenced, and subsequently, when The Landing was campaigning for a branch line to link its wharves with the main CPR line, scientific evidence for and against each harbour site was marshalled; and evidence of land speculation emerged (P. McKellar, 1914, pp. 19-20; Berton, 1970, pp. 233-239; Arthur, 1968, pp. 1-18).

The animosities kindled during the dispute led to a legal separation of the two communities. The Municipality of Shuniah had been incorporated in 1873 and had consisted of all the townships and settlements at the head of Lake Superior (*Statutes of Ontario*, 1873, c. 50). In 1881, Fort William, along with other townships, was removed from Shuniah Municipality and became a member of Neebing Municipality. Separate towns emerged shortly afterwards; the town of Port Arthur being incorporated out of Shuniah Municipality in 1884; and the town of Fort William out of Neebing Municipality in 1891. Thereafter, both became incorporated as cities (Port Arthur in 1906 and Fort William in 1907), possessing separate city councils and municipal offices; and both developed their own transit systems, police departments, power commissions and newspapers. Separate municipal development was paralleled by separateness in morphological development, each city developing its own central business district. Over the years these separate developments caused difficulties and hampered the economic growth of the Lakehead area. From the 1950's for example, inter-city passengers had to change buses at the common city boundary; the two cities competed against each other for industry and in attempts to underbid the other often conceded too much in the way of tax concessions; and two competing clusters of service establishments split the tertiary market so that, with certain exceptions, the array of items offered at the Lakehead was in tune with thresholds of half the population at the Lakehead instead of all of it.

This means that an individual establishment tends to be about half the size it could be were there not duplication in the other city; and it means that the consumer is faced with a restricted array of choice in one city's establishments , instead of the wider array of

choice available from a single establishment serving the whole Lakehead area. Indeed, this situation is almost forced on entrepreneurs for some residents of Port Arthur and Fort William will not even visit the other city. In the analysis of consumer travel behaviour (Chapters 4 and 5) particular attention is paid to differential use of both cities.

It is, perhaps, only on the frontier that such deep animosities, which may affect travel behaviour, could be engendered and maintained. The simple answer to the query of how it all started is perhaps that there was little else to do. The answer as to why it has persisted is more complex and might be related to the retention in present residents' minds of past events, the events of the frontier.

Attempts to achieve local government amalgamation were defeated in 1920 and 1950; but a rearrangement of local government boundaries was effected on January 1st 1970, when Port Arthur, Fort William, Neebing Township and McIntyre Township were incorporated to form the city of Thunder Bay (Malinoski, 1958; I.G. Davies, 1969, pp. 2-7).

POPULATION VARIATION

So far, in this analysis of Northwestern Ontario as a frontier area, people have been treated as a homogenous group save for diversity in occupation, the notion of maleness and the singling out of the Indian population. On the face of it, the population is much more heterogeneous.

Firstly, and as Hutchison perceived, there is considerable ethnic diversity. The French were particularly active in the earlier

phase of the fur trade era; and the Scots, especially in association with the North West Company, are accorded prime place in opening up the area. The Census demonstrates the present ethnic diversity of the area, in gross terms (Table 1.5).

But as ethnicity, for census purposes, relates to origin through ancestors, the census figures may convey a diversity more apparent than real. The individual would have to feel part of a smaller group and apart from the wider Northwestern society before it would significantly affect his consumer behaviour; and even if the feeling existed, the group would have to be large enough to constitute viable thresholds before ethnically-oriented establishments were provided.

The role of the frontier in the maintenance of ethnic group feeling may be examined. On the one hand, because the area is developing, there is ample scope for groups feeling themselves to be distinct to colonise distinct areas and set and maintain their distinct stamp on it. On the other hand the very hardship of occupying a difficult area, the same shared experiences, may tend to iron out original differences.

It is the writer's impression that only the Finnish-Canadians are sufficiently localised in large enough numbers and exhibit strong enough retention of language and customs to provide the possibility of differential spatial consumer behaviour. Orr (1971) has shown that Finnish-Canadians are strongly localised in the townships of Lybster, Gorham and Ware (Thunder Bay TD) and their concentration in Port Arthur is such that a Finnish shopping district, Bay Street, has developed there. The possibility of differential consumer behaviour, particularly in terms of distance, must not be

TABLE 1.5

NORTHWESTERN ONTARIO: ETHNIC ORIGIN OF POPULATION (1961)

Ethnic Origin	Total
British	87,558
French	20,290
Austrian	2,063
Czech. and Slovak	2,895
Finnish	13,645
German	10,332
Hungarian	1,318
Italian	11,108
Jewish	356
Netherlands	3,864
Polish	8,560
Rumanian	838
Scandinavian	12,537
Ukrainian	17,776
Other European	5,335
Asiatic	1,197
Indian and Eskimo	15,391
Negro	66
Other	1,399

Source: DBS, *Census of Canada*, 1961.

discounted, and this is investigated subsequently (Chapter 6).

Secondly, and apart from ethnicity, differences in income seem most likely to provide the basic differences in consumer travel behaviour, particularly where distances are great and the cost of overcoming them is high. To a certain extent differences in employment and occupation may induce differences in consumer travel behaviour, through different work locations, variable time off work, and varying social demands; but differences in employment and occupation may be allied to, and overshadowed by, differences in income. Nonetheless, the relationship between each and distances travelled is subsequently examined (Chapter 6).

SEASONALITY

Northwestern Ontario's climate cannot be claimed to be an intrinsic feature of life on the frontier; but those living on the Northwestern Ontario frontier are very close to their climate and very aware of it. Any examination of the relationship between the frontier and service provision and consumer behaviour in respect of climate must concentrate on the way in which climate mitigates or exacerbates any of the conditions of the frontier.

Generally Northwestern Ontario experiences climatic extremes: the low temperatures of winter contrast with the high temperatures of summer; a low summer rainfall is countered by a heavy winter snowfall within a framework of moderate precipitation; and the thunderstorms of summer are matched by the blizzards of winter. Winter seems to dominate men's minds and seems to last forever. In reality it lasts for only six months, from about

November to about April; ice break-up and snow-melt herald an almost imperceptible spring that leads into a short but enjoyable summer; which in turn yields to a short autumn.

The climate can be described in more precise terms, and figures based on long term observations at the Lakehead Meteorological Station provide a basis for this (Tables 1.6 and 1.7).

Mean monthly temperatures vary from 7.2°F. in January to 63.5°F. in July, but is worth noting that five months experience a mean temperature below freezing point, that five months experience a mean maximum temperature below freezing point, and that six months experience mean minimum temperatures below this figure. These means obscure the temperatures that people are aware of: January temperatures of between -25°F. to -40°F.; and July temperatures of between 80°F. and 90°F.

TABLE 1.6

MEAN TEMPERATURES (°F.): LAKEHEAD

Month	Mean Max.	Mean Min.	Mean Monthly
January	17.2	-2.8	7.2
February	21.0	-1.2	9.9
March	30.9	10.1	20.5
April	45.7	25.9	35.8
May	58.6	36.3	47.5
June	68.5	46.1	57.3
July	75.2	51.8	63.5
August	73.1	50.9	62.0
September	63.0	42.6	52.8
October	52.0	33.2	42.6
November	34.4	19.5	27.0
December	22.3	4.6	13.5

Source: Department of Transport, *Annual Meteorological Summary* (1968).

Mean monthly temperatures vary over the study area. In January the isotherms run east-west and the mean temperature of -6°F. in the southern part of the study area declines to -2°F. in the Red Lake area. The July isotherms run northwest-south~~west~~east, with mean monthly temperatures of over 66°F. being experienced in the Rainy River area; temperatures similar to the Lakehead characterising the Red Lake area; and the cooling effect of Lake Superior being most noticeable at the shore in the vicinity of Marathon (July, 60°F.).

TABLE 1.7

MEAN PRECIPITATION (ins.): LAKEHEAD

Month	Rainfall	Snowfall	Total
January	0.07	21.7	2.24
February	0.06	12.8	1.34
March	0.36	15.4	1.90
April	1.18	8.2	2.00
May	2.68	2.0	2.88
June	3.44	0.0	3.44
July	2.78	0.0	2.78
August	3.53	0.0	3.53
September	3.32	Trace	3.32
October	2.12	1.4	2.26
November	1.31	12.7	2.58
December	0.25	16.0	1.85
Total	21.10	90.2	30.12

Source: Department of Transport, *Annual Meterological Summary* (1968).

The Lakehead experiences a moderate precipitation, with much of the summer rainfall occurring as depressions tracking along the polar front or as a result of convective thunderstorms. The

striking feature is that of nearly eight feet of snow. Accumulation of snow, month-by-month, and heavy drifting render snow-clearing an important task. Most main roads are cleared within a day of a severe fall and are therefore passable; but icy road conditions, alleviated by salt and sand, still present a hazard to the unwary driver, particularly on winding and dipping Shield roads, where rock-cuts provide a dangerous reception to the vehicle that skids off the road.

Precipitation varies over the area, declining from the Lakehead figure to about twenty-four inches in the Red Lake area. Snowfall reputedly varies over the area and residents of the north shore of Lake Superior claim to lie in a snowbelt.

More important than the precise figures are the perception of seasonality and reaction to it. Residents of the area constantly stress to each other how cold it is, and outdo each other in recalling colder days (and worse blizzards). New immigrants and visitors are regaled with stories of low temperatures and blizzards, the implication of which is that these conditions are nothing to residents but something of which non-residents should beware. Certainly long-term residents do not seem to allow the long and cold winter to cut into their lives; rather they have adapted to it and turned it to their advantage. Ice fishing, motor races on ice, snowshoeing, ski-ing, ice hockey indoors and out, are winter preoccupations -- as is snow-shovelling. But much of this occurs in the settlements or close to them. It seems worth investigating whether residents face long-distance travel in the same way in winter as they do in summer; and this is examined in Chapter Six. It is worth speculating whether the apparent disregard for winter, and perhaps real disregard, stems

only from the fact of coming to terms with climate, or whether the notion of the hardy frontiersman allows winter to have less of an impact than it would in a non-frontier area.

SUMMARY

Few investigations have been concerned to examine the geographical aspects of service provision and consumer behaviour in frontier areas. Northwestern Ontario is held to represent a frontier area in terms of the irregular spacing of settlements, the high number of small settlements with restricted economic bases and the attitudes of its residents, attitudes conditioned as much by their sense of their area's past as by their perception of its present condition. Residents feel themselves to be distinct from residents of southern Ontario and within this feeling of separateness conditions exist which can provide the basis of internal differences, such as widely differing economic bases of settlement, ethnic, income and occupational differences. The principal aims of the remainder of the study are to establish how far this distinctive area differs from non-frontier areas in terms of service provision and consumer behaviour and to examine the area for any internal variations. The central place model is taken as a yardstick of non-frontier areas against which this frontier area may be compared.

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CHAPTER 2

RESEARCH METHODS

INTRODUCTION

This study is primarily concerned with two related elements of the geography of Northwestern Ontario: service provision and consumer behaviour. In this chapter the research methods employed are detailed: firstly those adopted in the analysis of service provision; and secondly those utilised in the analysis of consumer behaviour.

SERVICE PROVISION

In the following discussion of the methods utilised in the analysis of service provision three issues, array of functions, ordering of functions and centres, and grouping of functions and centres are dealt with in relation to existing literature. The method of ordering and grouping centres utilised in this study is detailed and its shortcomings discussed. Problems of data classification and collection conclude this section.

Preliminary Observations

Analysis of service provision could be performed at several levels. Firstly, each agglomeration of service equipment

in Northwestern Ontario could be described as a unique entity or each aspect of service provision could be described separately for the whole of Northwestern Ontario. Either of these procedures would involve considerable repetition, would be space-consuming, and would, probably, allow no clear patterns to emerge. Secondly, agglomerations of service equipment could be described in such a way that comparisons amongst them might be more easily observed and similarities and differences perceived. In general terms, the description involved at this second level involves greater simplicity and standardisation; in fact, an information loss. Both of these approaches may be termed qualitative and such qualitative study would reinforce the impressions of visual observation that, apparently, certain agglomerations are more complex than others, offer numerically more services than others, and offer more sophisticated services than others. At the intuitive level it appears reasonable to assume that the service agglomerations may be arranged on a scale running from the most complex to the least complex. (For example, the well-developed central business districts of Port Arthur and Fort William -- described in the first chapter -- contrast with the business streets of settlements such as Geraldton and Rainy River; and both contrast with the groups of stores found in unincorporated nucleations such as Kakabeka Falls.) Further, central place theory suggests that within this scale groupings of varying levels of functional complexity should exist. The qualitative approach, however, would be inadequate to attempt an ordering and grouping of service agglomerations, because the use of verbal description involves a sheer mass of information, which inhibits the ordering process and either obscures the presence of groupings or suggests groupings where none in fact exist.

It would appear, then, that a quantitative approach is required and research workers have developed and applied a variety of quantitative techniques. A comprehensive guide to these techniques is provided by Berry and Pred (1965, particularly pages 27-28), a classification of techniques and a critical evaluation of them is provided by W.K.D. Davies (1966), and Marshall (1969) has also provided examples of the shortcomings of certain techniques. Moreover, the writers of individual papers in which new techniques, or extensions to existing techniques, are set forth almost always identify problems of ranking service centres and review the shortcomings of earlier techniques or classes of technique. In view of the volume of literature which has accumulated on the topic it would be superfluous to present here a thorough review of each technique that has been developed. It is germane, however, briefly to mention the types of technique developed, to identify key issues, and to discuss crucial problems relevant to the present study. It is worth noting, also, that most research workers have concentrated on attaining objectivity in analysing inputs. Little attention has so far been devoted to the nature of the inputs themselves, which are often of a very subjective quality.

The basic aim of service centre ranking is to measure, in some consistent manner, the relative importance of a number of places so that they may be ordered and then grouped in hierarchical classes. W.K.D. Davies' classification of techniques (1966) identified four main types of measurement: direct, in which the service equipment of centres is considered (for example: A.E. Smailes, 1944; J.E. Brush, 1953; J.S. Duncan, 1955; I.G. Weekley, 1956); indirect, in which the power of centres to attract customers is measured either by the

extent to which they dominate the areas they serve (H.E. Bracey, 1953) or by the linkage between the nucleations and their tributary areas (F.W.H. Green, 1948; and S. Godlund, 1951); sophisticated, in which standard statistical techniques are employed to group settlements, apparently objectively (for example: B.J.L. Berry and W.L. Garrison, 1958a; M. Palomaki, 1964; and P. Scott, 1964); and calculation of potential status (for example: J. Reynolds, 1963; and E.P. Hammond, 1964).

Array of Functions

It may be inferred that all of these studies are attempting to assess the relative importance of settlement nucleations in terms of their roles in the tertiary economic sphere. The first key issue involves a decision as to what array of service activities may be considered as a meaningful base on which to make the assessment, but the issue does not explicitly arise if the method employed does not take account of the full array of functions and considers only indicators or key functions (for example: Smailes, 1944; Smailes and Hartley, 1961; Duncan, 1955; Brush, 1953; and H. Carter, 1955). When the full array of functions is being considered, and measured in some way, there are differences of opinion as to what to include and exclude. Thus Berry and Garrison (1958a) included state liquor stores and post offices but excluded newspapers. In the present study provincial liquor stores, provincial beer outlets and post offices are excluded from the array of functions to be measured. The presence or absence of these functions does undoubtedly add to the importance of a centre; but the presence of the functions, and the numbers of establishments of each functional type, need not be

closely related to demand inasmuch as government may be providing a subsidised service in places. In techniques relating numbers of functions or establishments to population this is a critical point, as it is in the technique used in the present study: in relating the number of functional types to numbers of establishments, establishments are in effect, being substituted for population (Chapter 3).

Less understandably, Berry and Garrison (1958a)included the fact of incorporation, and the presence or absence of public utilities (water supply system and sewage system, for example) which would appear to bear little direct relationship to a centre's service role. It is true that in Ontario population levels are used as a yardstick for the granting of municipal status and for the progression of communities from one status to another (*Revised Statutes of Ontario*, 1960). The Ontario Municipal Board, however, can grant permission to a community to incorporate itself before the standard population total is reached and, equally, no community need incorporate when the population level is met and passed. Similarly, the presence or absence of public utilities reflects the decisions of voters and their elected representatives as much as it does the importance of a place in its service role. Thus, in this study public utilities are excluded from the array of functions.

In part, differences of opinion stem from variations in the nature of the study areas and it may be surmised that each worker, or team of workers, defines the array of functions to suit local conditions. Given that Northwestern Ontario is a frontier area, in which goods and services may be provided wholly or partly by government or corporation subsidy, the array of functions considered in this study has been selected in relation to the area rather than

with the decisions of other research works in mind. In part, however, differences of opinion reflect differences in the aims of the studies. One study, for example Smailes (1944), may be attempting to define a hierarchy of urban settlements, whereas another worker, for example Weekley (1956), may be attempting to define a hierarchy of shopping settlements. In the latter case it is to be expected that inputs to the measurement technique will be restricted to retail functions and in the former case it is clear that other functions in addition to retail functions will have to be considered.

In this study the emphasis is on consumer behaviour, particularly on consumers travelling to obtain goods and services. Accordingly, the measurement of the status of centres is restricted to functions which might conceivably be directly related to consumer movement. Thus wholesaling functions are not considered, nor are municipal, provincial and federal administrative functions.

Ordering of Centres

The second key issue is the technique employed to order settlements, from most important to least important. The importance of a settlement is a comprehensive and unified concept, yet the elements of that unity are disparate. The main problem is to devise a system of measurement which will allow the expression of unlike phenomena in valid and similar terms and which will allow both consideration of the full array of functions present in a settlement and their relative degrees of specialisation.

In establishing three orders, or ranks, of central villages, Bracey(1962, pp.169-190) employed direct summation in two different

ways and linked the results. In the first place he summed the number of establishments (shops) within one functional class (retailing) and, secondly, he considered the number of occurrences of seven professional services. The groupings he adopted depended on the number of establishments (shops) linked with the number of professional services. The adequacy of straight summation may be debated. For example, both Castle Cary and Bruton are recorded as possessing thirty-six shops (Bracey, 1962, p.182) but the numbers of establishments in the three classes of shop (food, clothing, and household) vary between the two places:

	Food	Clothing	Household
Castle Cary	18	10	8
Bruton	15	9	12

Leaving aside the issue of the importance of each individual establishment, is it reasonable to assert that two places have similar importance because the total number of establishments are similar, or as in this case, identical, when the compositions of the totals vary? Given the small universe within which Bracey worked, and given the probability that he was working with a small range of central places at the lower end of the central place hierarchy, the method would seem to be adequate; but it would be inadequate for work encompassing a large range of the central place hierarchy and including the middle and upper levels of that range, for non-specialised establishments such as food stores would be given a weight equal to that of more specialised establishments such as bookstores.

The same drawback of equal weighting being accorded to establishments within the same broad functional types applies with

similar or even greater force to the practice of according the same weighting to establishments in different functional types: for example, counting a food store as one unit and a doctor as one unit.

Both facets of the problem could be overcome, theoretically, by adapting a weighted points scheme whereby less specialised establishments are accorded less points than more specialised establishments, but the subjectivity involved in deciding upon the differential weightings could reduce the validity of the results.

Both summation of totals and a weighted points scheme may be considered as crude methods of expressing unlike phenomena in the same terms. A more refined method would be to express establishments in terms of area or volume, a method moreover that would incorporate the variation in establishment size. It would, however, involve assumed relationships between space occupied and space utilised, and between space occupied and work performed. In any event, such a method could not be utilised in this study because of the impossibility of obtaining the necessary data. At the time of the field research all assessment records, formerly held by each municipality, were being consolidated in regional assessment offices and were thus inaccessible. Due to the diversity of assessors, the writer felt that the municipal records, even had they been available, would have been of limited value.

Another method of expressing unlike phenomena in similar terms involves the indirect approach (W.K.D. Davies, 1966, pp.56-58), whereby the fact of consumer patronisation is used to rank settlements (Bracey, 1953) or the linkage between consumers and settlements is assumed to be represented by the relative intensity of telephone installations (W. Christaller, 1966) or by the presence or absence of motor-bus services (F.H.W. Green, 1948) or by air passenger traffic

(E.J. Taaffe, 1962).

Apart from the fact that intensity of use of a settlement by consumers is assumed to follow from other phenomena, from telephone installations or from motor-bus services, both methods would be inapplicable in the present study because of the non-business use of the telephone and the use of the private motor car. It is generally recognised that the level of bus services in Northwestern Ontario is poor, particularly in terms of frequency. This is partly a reflection of widespread car-ownership motivated as much by the search for status as by need and by the notion of self-reliance on the part of frontier society. (Air passenger traffic could not be related to the aims of this study.) Whereas Bracey's use of consumers may be faulted on grounds of suspect methodology, in view of the inadequate sample and restricted array of instances of behaviour examined, the present study, it is believed, avoids both of these charges and is less suspect methodologically. Thus it is possible to use the established facts of consumer patronisation to order settlements and it is possible, by considering distances travelled, to order functions. The problem of grouping settlements, or functions, or both, after initial ordering, still remains.

Grouping of Centres

Four attempts to group functions, or the centres possessing those functions, may be mentioned: inasmuch as they all proceeded further than direct summation of functions in establishing ordering; inasmuch as they all considered full arrays of functions; and inasmuch as they all attempted to group settlements, after initial ordering, according to objective methods.

In what has come to be regarded as a classic paper, in that it stimulated a search for more objective methods of determining hierarchies of central places and served as a model for subsequent studies (Palomaki, 1964, for example; and L.J. King, 1961), Berry and Garrison (1958a) presented arresting and convincing evidence for the existence of a hierarchical system of central places, at least in part of Snohomish County, Washington, U.S.A.

In terms of technique, Berry and Garrison recorded two achievements. Whereas they did not incorporate the sizes of establishments in their study, they based the ordering of functions on more than a crude enumeration of their frequency of occurrence by relating, for each function, the spatial association of numbers of establishments with numbers of people supported by those establishments. This technique assumes a relationship between the number of people at a place and the number of people in the area served by that place; or, in other words, the known population (of the place) is being used as a measure of the unknown population that patronises the place. Such an assumption is perhaps valid when there are strong grounds for believing that the populations of the centres are engaged in tertiary occupations serving contiguous rural areas; but in the case of the present study, when it is known that the majority of the populations of most settlement nucleations are occupied in tasks unrelated to the needs for service of other nucleations, or rural areas, straightforward use of nucleations' populations as inputs to ranking techniques is invalid.

This point would seem to render any further examination of the Snohomish County study fruitless in terms of the present study but one facet of that study is germane. Berry and Garrison draw a

distinction between functions with varying numbers of establishments in places (calling these variates) and functions either present, in the form of one establishment, or absent (calling them attributes). Variates are ordered along a continuum according to threshold populations established by linear regression, and attributes are ordered along a continuum according to the strengths of results derived from applying the test for point biserial coefficient of correlation. The significant point is that there are two inputs in each case: number of establishments and, indirectly, population served. Thus the inadequate crude summation of either functions or establishments, or combined summation, is avoided.

After the initial ordering of functions in these two sets, Berry and Garrison attempted to group the functions, following a method developed by P.J. Clark and F.C. Evans (1954). Both sets of ordered functions were found to fall into three groups, which corresponded to three classes of central places themselves determined by applying the Clark-Evans technique to an ordering of centres based upon the number of functions and population in each place. L.J. King (1961), P. Scott (1965 and J.U. Marshall (1969) have all contributed to a demonstration that the groupings derived by application of the Clark-Evans technique are not as objective as they at first appear, and that a greater or lesser number of groupings may be obtained via the method, depending upon the lengths to which the researcher is prepared to go. This apart, the Snohomish County study does demonstrate the usefulness of obtaining more than one set of data to arrive at a conclusion.

M. Palomaki (1964), in a study which has suffered in the translation from Finnish into English, attempted to group

hierarchically the settlements of South Bothnia according to several lines of evidence: administrative, wholesale, retail, medical, educational and recreational, and "miscellaneous". He found that each of these six broad functional classes possessed from two to six hierarchical groups and decided that a six-rank hierarchy of settlements characterised the study area. The relative placings of orders of functions were manipulated (p.161) to give a general hierarchy of settlements with six ranks or levels, and this writer finds the manipulation so subjective that much of the objective work that precedes it is, in a sense, wasted; and W.K.D. Davies (1966) has criticised some of this preceding work as being too subjective. The notion of attempting to marshal several lines of evidence in support of an end result should be borne in mind.

In a study of Southwestern Iowa, B.J.L. Berry, this time working with H.G. Barnum and R.J. Tennant (1962), utilised direct factor analysis to group both functions and settlements. Although the findings appeared to demonstrate the existence of a continuum of central places, rather than discrete levels of central places, Berry claimed the existence of three "regimes". As Marshall (1964, p.56) points out, a smooth curve with no obvious breaks on a graph does not intrinsically disprove the existence of hierarchical structuring: for more than one complete system of central places may be included within the graph, and Berry (1967) has shown that the composition of different hierarchical systems may vary in terms of complexity and levels attained. Hence, it would appear that information on the spatial behaviour of consumers is a necessary adjunct to information on the service equipment of the settlements to prevent more than one system being represented on a graph and thus

allowing any breaks that do exist to be more readily perceived.

Ranking Technique Adopted

The present study, however, focuses more on consumer behaviour than on service provision; and information on service provision is better regarded as being ancillary to that on consumer behaviour, rather than vice-versa. With this emphasis the writer was compelled to adopt a method of analysing service centres which would avoid the subjectivity of the "key-function" approach and the crudeness of direct summation but which would not involve treatment of data as elaborate as that of factor analysis.

Thus the writer decided to follow the method employed by Scott (1964) whereby ordering and grouping of central places, in Tasmania, was effected by summing each central place's functions and each central place's functional units and using the data-pair to establish the position of the central place on a semi-logarithmic graph.[1] Examination of the relationship between the numbers of functions and the number of functional units (establishments), as portrayed on the semi-logarithmic graph, led Scott to identify three breaks in slope and four separate regimes, although it was not possible, Scott claimed, visually to assess the first two regimes. Each of the three regimes containing enough members was subjected to

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[1] It is inferred that by "functional unit" Scott meant establishment or a discrete business enterprise, whereas Berry *et al.*, (1962, p.68), defined "functional unit" to mean "the part of a store performing a single central function, in the event that more than one function is performed by the store". Marshall (1969, p.58, footnote 31), is of the opinion that "the difference is not sufficient to warrant attention". The difference does cause problems, dealt with subsequently, in the present study.

linear regression analysis, and in each case the coefficient of linear correlation exceeded 0.945 at the 0.01 level of confidence.

At the time (1967) at which the writer decided to employ Scott's technique he was aware of R.J. Johnston's (1965) criticism of it but then, as at the time of writing, he would disagree with Marshall that it "... amounted to no more than an exercise in self-delusion ..." (1969, p.58). Johnston felt that the use of the semi-logarithmic graph had perhaps suggested to Scott breaks that would not have been so readily identified on arithmetic graph paper and Johnston demonstrated that it was possible subjectively to break, an equal number of times, the same curve at different points, thus producing different regimes. (Also, it may be suggested that the same curve may be broken a varying number of times, again producing different regimes.) Johnston concluded by suggesting that the Clark and Evans technique would produce a less subjective result.

In the accompanying rejoinder to Johnston, Scott (1965) points out the Clark and Evans technique contains subjective judgement on the decision as to how far to carry the analysis and, further, points out that Johnston's example consists of an extremely theoretical pattern consisting of a few uniformly-spaced points approaching a continuum. Scott holds that Johnston overstates his criticism and, perhaps, so does Marshall: Scott admitted to the subjectivity of his technique, thus he was hardly deluding himself. Moreover, although Scott did not perform factor analysis on his groups, he did subject them to two checks: "the frequency of distribution and the characteristic functions of each group" (1965, p.317). It is difficult to support Marshall's claim (1964, p.39), that "other evidence" in support of the regimes chosen was *not* given. Scott

did give the evidence in his 1964 paper; he merely referred to it in his 1965 rejoinder. That even more clearly recognisable regimes did not emerge from Scott's data is perhaps due to the fact that he had no information on the spatial behaviour of consumers and it is possible that he was considering at least two hierarchical systems, one centred on Launceton and one centred on Hobart; and perhaps more than two. It becomes evident that information on the spatial behaviour of consumers is an integral part of the process of ranking service centres.[1]

Before outlining in detail the method of ranking utilised here, the issue of subjectivity and objectivity in the grouping of centres into ranks may usefully be discussed. Smailes (1944) points out that no matter how objective the techniques are or appear to be, because one is examining a dynamical situation at only one moment in time some subjectivity will be needed:

> Any grading, however, must in some measure be arbitrary, since the urban scale is as continuous as the social scale. Yet the indefiniteness of the boundaries in neither case warrants denial of the reality of stratification.

Marshall (1969, p.47), quoting these lines, finds the statement curious, but he does not quote Smailes' elaboration: "Towns are constantly rising or slipping back in the urban scale, and this fact of vertical mobility is very real." Scott (1965, p.317) developed the point in greater detail:

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[1] Scott did not seem to relate the breaks on his graph to his own field experience. Such a relationship is sought subsequently in this study (Chapter 3).

> Almost all central place studies tacitly assume that the systems are in long-run equilibrium. In fact, the systems are proceeding through successive phases of disequilibrium, each tending toward but never reaching a probably changing position of equilibrium ... In Tasmania ... there are so many places changing in status that the divisions, especially at the lower end of the hierarchy, are inevitably somewhat blurred.

Working within the smaller universe of the Greater London Area and focusing on shopping centres rather than urban centres, Smailes and Hartley (1961, p.204) point out that over much the range of the scale of service provision developed by them (shown in their Figure 1):

> Clear steps are absent, and there seems a basis for recognising three ranks, and for distinguishing within them places whose equipment is undoubtedly appreciably superior or inferior to the norm.

It is not surprising that Smailes and Hartley experienced "problems ... in assigning places [shopping centres] to respective grades ..." and some subjective judgements were apparently employed; however, Smailes and Hartley, (p.204) believed that the subjectivity "added to the truth of the general picture".

Bracey (1962, P.180) also addresses himself to this problem. After refining his data on the service equipment of central villages in Somerset to produce three orders of central villages he concludes:

> It is possible that the method of analysis used in this paper has over-emphasised the divisions between the different orders of central villages ... In the present paper I have arranged central villages in three orders according to functional development for convenience of study. But the three

orders tend to overlap or shade into each other.

All of this seems to amount to researchers having an intuitive belief that a hierarchy of central places with discrete ranks exists but being unable to demonstrate it conclusively due to inadequacies of technique or movement of centres within and between ranks. This problem is relevant to the present study. In the first chapter the possibilities of demand and supply being poorly adjusted to one another under frontier conditions were discussed. Also recent imporvements to the road system may have initiated a trend towards more long-distance travel with smaller service centres losing business as a result. In this study evidence of a hierarchical structuring of service centres is sought, the methods of analysis are as objective as possible, but subjective judgment as to the validity of the results is necessary.

Data Classification Problems

Having outlined the crucial issues involved in the process of ranking service centres and having identified the method selected for use in the present study, some examples of the problem faced in classifying data will be given.

It had been decided to order settlements, and possibly to group them, on a basis of the relationship between numbers of functions and numbers of establishments. Thus, before fieldwork was commenced it was necessary to compile a classification of functions within which establishments could be assigned. This compilation proved difficult in terms of both good and service provision and slightly different procedures were employed in enumerating retailing outlets and establishments concerned with service provision.

(a) Goods

Within the complete sphere of retailing it is possible to conceive of, and to perceive, establishments offering slightly varying arrays of goods but establishments, nonetheless, that may be identified accurately by the same name. For example, listed below are various arrays of goods for four establishments:

Array 1. Vegetables, Canned Foods, Confectionery, Wrapped Bread, Fruit, Dairy Products, Beverages, Cigarettes

Array 2. Vegetables, Canned Foods, Frozen Meat, Fresh Bread, Fruit, Dairy Products

Array 3. Gourmet Meats, Gourmet Cheeses, Smoked Fish, Shellfish, Fresh Bread, Gourmet Cooking Media, Vegetables and Regular Canned Foods

Array 4. Vegetables, Canned Foods, Beverages, Cigarettes, Newspapers, Cooking Media and Variety Goods

It would be possible to classify all four establishments as food stores on the basis of the arrays of goods offered for sale. Alternatively, it would be possible to classify Array 3 as denoting a specialised food store, especially if data on sales were available and showed that sales of gourmet food constituted a significant proportion of the establishment's income. Detailed data on sales are, however, extremely difficult, if not impossible, to obtain; and even if they could be obtained if would be exceedingly difficult to establish the levels of significance of sales. Similarly, Array 4 could be interpreted as denoting a general store, particularly if sales of cigarettes, newspapers, and variety goods assumed a significant proportion of total sales. In the absence of accurate data on sales and in view of the difficulty of recognising significant levels, the subjective approach of noting the

establishment type, via signs, and of entering the establishment and deciding the relative significance of sales of various goods within the establishment's total array, is considered adequate. This means, then, that establishments are being classified by functional type rather than by function, for many establishments perform a number of functions, which are usually allied to each other.

Some other examples of the difficulties of establishing the classification may be cited. The class (or functional type) "general store" includes those establishments offering a wide array of goods: food -- fresh, tinned and frozen; small household items, such as cutlery and cooking utensils; variety items, such as paperback books, watches, children's toys; and cleaning utensils. In small settlements, there are occurrences of general stores and food stores each with two petrol pumps (one dispensing premium fuel, the other regular). In this study general stores with petrol pumps are still classified as general stores; food stores with petrol pumps as general stores. Thus the filling station class does not have these establishments credited to it: the existence of some filling station functions is lost. The only alternative would have been to consider functions, not functional types, and thus, in the latter case two functions would have been recognised: the food store function and the filling station function. This would have overrated the service available, for generally a filling station sells not only gas, but also minor parts, and most filling stations can effect at least small repairs. To a certain extent this dilemma is created by the broad level of generalisation at which the classification is being performed, and the only way of resolving it is to refine that level to

a high degree of specificity, recognising in this instance the following functions: petrol sales; oil sales; petrol and oil sales; petrol and oil sales, and small-parts sales; sales of goods, and small repairs; sales, small repairs, and servicing; sales, small repairs, servicing, and major repairs; sales, small repairs, servicing, major repairs, and major part sales. Such a refined classification still would not include establishments which sell new cars, and used cars, and which frequently carry out body repair work. An additional difficulty posed by the use of a classification as refined as this would be the difficulty of establishing any internal consistency within groups of settlements recognised on a basis of relationships between functions and establishments.

A second classificatory difficulty may be detailed. Following Berry and Garrison (1958a) it was decided to enumerate as two separate functional types men's hairdressing establishments (barbers' saloons) and ladies' hairdressing establishments (beauticians). There are instances, however, of single establishments combining both functions. One solution would have been to create a third functional type to incorporate such establishments, but often it appeared that one of the functions was very subsidiary to the other. Further, once the classification is refined in this way, further distinctions would be called for, for example differentiating between establishments of all three types which either made sales of toilet products or did not. Thus, this solution was rejected. Another solution would have been to award to each of the men's hairdressers and ladies' hairdressers classes one unit, but this might have overvalued the service available inasmuch as there might be insufficient demand for two establishments, each of a different type,

and the only way both services are made available is through a combined enterprise. The third solution (and the one adopted) is to classify, in any one settlement, combined establishments alternately into the men's hairdressers functional type and the ladies' hairdresser functional type. Careful note was taken, in the field survey, of combined establishments with an emphasis on one of the two functions; and, in the event of an odd number of combined establishments occurring in a settlement, that establishment with the most apparent emphasis was allocated to the one of the two functional types with which it was most consistent.

After pilot surveys of establishments to identify difficulties such as those identified above it was decided to use a modified version of the classification of functions employed by Berry and Garrison (1958a) in their Snohomish County study. Partly because the Snohomish County study was dealing with settlements less complex than those encountered in the study area, it was necessary to create additional classes of functional type.

It may be that the use of the functional type "apparel store" undervalues the status of the most complex settlements in Northwestern Ontario, for example, when general shoe retail stores, men's shoe retail stores, women's shoe retail stores, men's apparel stores, are all classified together; but once the general functional type is discarded, the problem of where to stop the process of refinement is encountered.

One functional type used here (and taken from Berry and Garrison), "food lockers", must be explained in the light of W.K.D. Davies' (1965, p.223) interpretation:

> Thus frozen food lockers are distinguished as a separate type of business -- an array of goods that need [*sic*] a special fitting

> within the establishment before they can be sold.

The writer interprets Berry and Garrison's use of the term, and uses it thus, to mean the provision of deep-freeze facilities in which customers may rent space for storage of foodstuffs. W.K.D. Davies interprets the term to designate the retail good "deep-freeze unit".

(b) Services

In the sphere of services, particularly professional services, difficulties of classification were also encountered. The functional type "lawyer", for example, is easily identified but establishments performing the function contain a varying number of qualified lawyers, as well as a varying number of support staff. Because no account of numerical variations in employees is taken into consideration of retail outlets, it may be argued that a legal office housing five lawyers should be counted as one occurrence of the functional type "lawyer", in the same way that one legal office housing one lawyer would be counted. The relationship between number of employees and business conducted in retail outlets is not as straightforward, however, as that between the number of lawyers and legal business conducted and, in this study, the total number of lawyers in a place is considered to constitute the number of "establishments" within the functional type.

The relationship between physicians and clinics poses a more difficult problem. For example, the survey of Port Arthur revealed a total of 69 physicians and 5 clinics. Physicians, however, practise in the clinics. The choices are: to count no clinics and *only* physicians; clinics and *no* physicians; or,

clinics *and* physicians. The last choice has been accepted on grounds that the joint practice involved in a clinic produces a greater importance for a place than the sum of the individual physicians' practices.

Thus the pilot surveys undertaken in June of 1968 and conducted with the modified Berry and Garrison classification established the array of problems that would be encountered and indicated the nature of the information that would be required.

Data Collection

In an attempt to reduce the amount of field work required for the survey of business establishments and also to improve its comprehensiveness, two sets of published information on business establishments were consulted prior to the field work: post office householder directories and telephone directories.

The householder directories contain no information of direct use in establishing the number of retail establishments located in a place, but as 119 different "lines of work engaged in by householders whose names appear" in the directories are identified they are a useful guide to the numbers of physicians, dentists, lawyers and differentiation of those designated "Dr." in telephone directories, who could be either physician, dentist or veterinary.

The classified directories of the telephone directories are useful guides to the number of different functional types of retail business and of service business found in a place, but they are not comprehensive sources of information; nor, in many cases, is the information on a particular establishment complete enough. Firstly, a comparison of the classified section of a directory with

the unclassified section reveals that the same business establishment may be listed more than once in the classified section and that some business establishments are not listed at all in the classified section. Secondly, some business establishments which have telephone numbers that make it appear that they are located within a particular settlement are in fact located outwith that settlement: the listing designates the telephone exchange through which the business establishments may be reached, not their locations.

In general, the householder and telephone directories provided a guide to field work and prevented the overlooking of small business establishments difficult to locate in the field.

In July of 1968, the writer drove over every road in Northwestern Ontario, both rural and urban, and carried out survey work on foot in the cores of urban areas. For each type of business establishment the following data were collected: name of the firm; self-designation of functional type; array of goods on sale, or array of functions performed; and functional type.

Information on locations proved difficult to systematise. If the enterprise was located within the municipal boundary of a nucleated settlement it was recorded as part of that necleation's service equipment; if it was located outwith the municipal boundary, but still within the built-up area, it was not recorded as part of the nucleation's service equipment (unless it satisfied the distance criterion discussed subsequently).

It is pointed out in the first chapter that many settlement nucleations in Northwestern Ontario have no municipal boundaries: they are not themselves incorporated, although they may (and often do) occur within territory organised as rural municipalities.

Again, dwellings and business enterprises, or business enterprises themselves, do not always constitute clearly recognisable settlement nucleations: there is difficulty in deciding whether or not a nucleation is present; and even when it is decided one is present it is difficult, in many cases, to decide where it begins and ends. This lack of both formal and functional organisation is, perhaps, an integral characteristic of a frontier area. The largest scale of official map coverage for the whole of Northwestern Ontario is provided by the Canadian National Topographic System at 1:250,000. On these sheets different symbols represent "towns" (settlements incorporated as towns) and "villages or settlements". Towns are found on the ground where "towns" are marked on the map sheets; but not all "villages or settlements" marked on the sheets correspond at all to any form of structure on the ground -- for example, Matherford, Box Alder and Big Fork, all in the Rainy River District. Thus the map sheets do not constitute reliable guides to the existence of settlement nucleations; nor do they provide accurate information on the extent of settlement nucleations.

To decide whether or not business enterprises in the vicinity of clearly-perceived settlement nucleations should be included as part of the nucleation, and to decide whether or not an apparent string of establishments lining a road should be considered as a nucleation, it was necessary to decide what distance should be allowed to separate the establishments for them to be considered as part of the same functional settlement nucleation. This distance might have been decided upon as a result of systematic observation: observing customers walking or driving between two or more businesses, but time and cost militated against such a study and it was not conducted.

To aid in the selection of a separating distance the practices of other workers who have had to face this problem were examined. G.T. Trewartha (1943, p.37) in attempting to identify unincorporated hamlets in part of Southwestern Wisconsin adopted the following rule:

> In a hamlet composed of the minimum number of buildings, the maximum linear distance between the outermost buildings should not exceed one quarter mile [1,320 feet].

In providing an operational definition of a business district, within the city, Berry *et al.*, (1962, p.68) adopted the following criterion:

> a group of spatially contiguous establishments less than 300 feet from each other, and *either* separated from other establishments by more than 300 feet at the periphery *or*, if in a continuous shoestring of business falling into "peaks" or "ribbons" of land values ...

Trewartha appears to have lacked accurate large-scale maps and his distances were visually estimated; whereas Berry *et al.*, presumably, did have accurate large-scale maps. The writer, in many cases, had only maps of the scale 1:250,000, from which distances of the order of 300 feet to 1,320 feet were difficult to measure. Moreover, the maps were, in many instances, inaccurate. Visual estimation of distance is difficult, particularly in areas of sparse farm settlements where no lot boundaries exist as guides, therefore it was decided to utilise a car odometer, which provides accurate distance information in tenths of one mile. The writer felt that one quarter of a mile was too great a maximum separating distance and decided upon the distance of one tenth of a mile (528 feet).

The excluding effect of the adoption of this distance can be seen in the distribution of a string of establishments along one of the major arteries leading out of Fort William (distances in

tenths of one mile):

Florist
0.3
Pharmacy
0.3
General store
0.8
General store
0.4
Motel
1.6
Restaurant
0.2
General store
0.6
Church

Intensive investigation in the field revealed that no local residents considered a settlement to exist along the whole, or part, of this 4.2 mile stretch of highway.

In view of the large number of single establishments lining the highways of Northwestern Ontario it was decided to eliminate them from further consideration and define a service centre or central place as any arrangement of two establishments located within one tenth of a mile of each other and with access between them. This definition thus conflicts with that of Scott (1964, p.139):

> ... the minimal requirements of size and nucleation for a settlement to rank as a hamlet were defined ... as two central functions located sufficiently close together to be regarded by the local residents as constituting a central place.

It is inferred that Scott meant two establishments of a distinctly different functional type. It has been pointed out that different arrays of goods can be offered by two establishments classified in the same functional type. For example, the arrays of the two general stores cited above in the distance study differed: the first listed sold groceries and petrol; and the second listed

sold petrol, groceries, ammunition, paint and fishing tackle. Had they been located within one tenth of a mile of each other, to define a central place as at least two establishments of different functional classes would exclude their location from designation as a central place; to define a central place as at least two establishments, irrespective of difference or similarity in functional type, would include their location in designation.

CONSUMER BEHAVIOUR

The term consumer behaviour is wide in scope and embraces a complex set of interrelated decisions and events. In any particular study it is necessary to focus on certain aspects of consumer behaviour and this study concentrates on the centres consumers visit to obtain selected goods and services and the distances involved; and it examines in less detail spatial and temporal variations in consumer travel behaviour, patronage motivation, the role of catalogues and variations in consumer behaviour of segments of the population stratified according to age, ethnicity, occupation, employment and income.

Preliminary Analysis

Published information of this type and in this detail on Northwestern Ontario does not exist. *The Financial Post*'s annual survey of markets does provide some scant information. The *Survey of 1966/67* (1967, pp.189-192), for example, provides very general information on the retail trading areas of three of the centres in the study area:

FORT WILLIAM	Fort William; Port Arthur; Nipigon; Schreiber; Geraldton; Beardmore; Red Rock; Steep Rock (Atikokan); Marathon; and Terrace Bay.
PORT ARTHUR:	Port Arthur; Little Longlac; Beardmore; Jellicoe; Marathon; Terrace Bay; Red Rock; Nipigon; Schreiber; Geraldton; Kakabeka Falls; Murillo; Hymers; Shebandowan; Stanley; Pass Lake; and Steep Rock.
KENORA:	Kenora; Fort Frances and Rainy River District; Sioux Lookout; Dryden; Red Lake; McKenzie Island.

This type of information is very general; it provides an overall picture of a retail tributary area but provides no data on possible variations in the various retail service areas that in concert constitute the retail tributary area; and it provides no measure of the intensity of the linkages between each of the three centres and those places designated as falling within their retail trade areas. Despite its generality, this information does suggest a distinct identity for Port Arthur and Fort William (and the evolution of the cities' identities is described in Chapter 1); and, also, it suggests that the Port Arthur retail trading area is more extensive and includes more centres than does the Fort William trading area. (It should be borne in mind that no information on the reach of professional services, from these three centres, is included.) By not including the settlements in the western part of the study area (Fort Frances, Dryden, and Kenora, for example) within the Port Arthur and Fort William retail tributary areas, the information suggests that either these settlements do not lie within any other larger centres' retail tributary area or that they do, in which event the most likely choice is that of Winnipeg.

Given the inadequacy of published information some form of field survey of consumer behaviour was necessary and the field survey conducted fell into two parts: analysis of selected records in an attempt to define broad tributary areas; and a sample survey of households.

One method of establishing retail trading areas is to analyse either charge accounts or records of sales at various retail outlets. The method is limited in that not all consumers have charge accounts; the existence of a charge account does not necessarily indicate actual purchases; and the consumers may have purchased by catalogue all or some of any items charged to them. Further, those records of sales examined were incomplete and provided information at varying levels of usefulness. In any event, the writer was unable to secure access to a sufficiently broad and complete set of records and the method was rejected.

Where sales information of an array of retail establishments cannot be obtained, Smailes (1953, pp.138-139) has suggested that data on the frequency of newspaper publication may be utilised to infer the status of centres and that data on newspaper circulation may be used to infer tributary areas:

> Another index of the field of an urban centre and one for which special importance may be claimed, is the circulation area of its newspapers. In nearly all towns and indeed in many places which can scarcely claim recognition as fully developed towns, a weekly newspaper is published and distributed over the surrounding district.

Smailes continues by pointing out the relationship, an assumed relationship, between newspaper advertisement, circulation and consumer patronisation of retail outlets. Subsequently, Smailes (1953, p.146, Fig.21) shows that the circulation area of

Middlesborough's daily evening newspaper is more extensive than that centre's retail delivery area; and shows (p.151, Fig.22) that Ballymena's "general urban field" must have added to it an "additional area for Newspaper and Secondary School". At best, then, data on newspaper circulation provide a guide to tributary areas.

Data on newspaper circulation in Northwestern Ontario falls into two types: that provided by the Audit Bureau of Circulations, which includes information on total circulation and distribution, and on frequency of publication; and that provided by the *Ayer Directory of Newspapers and Periodicals*, which includes information on total circulation and frequency of publication only.

The writer was able to obtain the first type of data for only three newspapers originating in Northwestern Ontario: *The News-Chronicle* (Port Arthur), evening daily, except Sunday; *The Times-Journal* (Fort William), evening daily except Sunday; and the *Canadan Uutiset* (Port Arthur), weekly and printed in Finnish. In addition comparable information was obtained on the *Globe and Mail* (Toronto), morning daily except Sunday, flown into Lakehead Airport and distributed from Port Arthur.[1] Data on the remaining newspapers originating in Northwestern Ontario fell into the second type and were of more limited value. The data available, however, were judged useful in establishing broad details of the retail tributary areas of Port Arthur and Fort William (Chapter 5).

Whereas it may be argued that data on newspaper circulation is useful in delimiting retail tributary areas, the same argument

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[1] Information supplied by R.L. Rice, Esq., Lakehead Distributor of the *Globe and Mail*.

cannot be advanced in respect of delimiting professional service tributary areas, as members of some professions (physicians and lawyers, for example) do not advertise, or are prohibited from advertising, in order to seek business. Because attempts to delimit retail tributary areas of centres by analysis in the centres themselves are inadequate (and this study aims at more than mere tributary area delimitation, it would be inconsistent comprehensively to infer the professional service tributary areas on a basis of newspaper circulation. To complement the study of newspaper circulation areas, however, a study was made from very detailed records of the domiciliary distribution of patients admitted to Lakehead Hospitals (Chapter 5).

Clearly, a field survey of consumers in Northwestern Ontario was required if the aims of this part of the study were to be realised. It was clear too that, whereas sampling would be required in larger communities, on grounds of time and cost, such a large portion of the population of small communities -- and Northwestern Ontario has many small communities -- would have to be included in the samples drawn from these places to bring the absolute number of responses to a workable total, that the extra time and cost involved in full survey of them would be balanced by the saving of labour in inferring from sample populations to whole populations.

The possibility of full survey for even small communities was rejected in the light of the experience in one of the pilot sample surveys where a high proportion of chosen locations had to be revisited, and one visited a third time, before contact with respondents could be established. In full survey, the numbers of initial and second non-contacts would have been prohibitive,

particularly in an area such as Northwestern Ontario where settlements and individual dwellings are so widely dispersed. Thus, on this ground, and on the ground of consistency, it was decided to carry out a sample survey of consumers in the study area.

This decision in turn raised the interdependent issues of sampling frame, sample size and method of obtaining the information. To aid in the resolution of these issues two pilot sample surveys were conducted, in late May and early June of 1968: one in Manitouwadge and one in Red Rock.

The pilot sample survey in Manitouwadge aimed primarily to test the response rate of a ten per cent systematic sample of households, drawn from those households listed in the post office householder directory, to a postally administered questionnaire. Each individual with a postal address in Manitouwadge is alphabetically listed in the directory and the postal address indicates whether or not persons of the same surname are members of the same household.

Eight hundred and sixty-nine households are listed for Manitouwadge and the ten per cent sample of eight-seven was chosen by selecting every tenth household from a randomly chosen starting point within the first ten households listed. One shortcoming of the post office householder directory as a sampling frame was revealed when ten of the questionnaires originally mailed out were returned marked: deceased (2); unclaimed (3); moved, address unknown (1); unknown (4). Fourteen completed questionnaires were returned in the addressed and pre-paid envelopes provided: therefore, sixty-three households failed to respond. On the basis of this evidence, the method of postal administration was rejected as

a method for the projected sample survey.[1]

The secondary aim of this pilot sample survey was to test question-acceptability, and to gather responses to open-ended questions that would be used in formulating classes of response for use in closed-ended questions in the projected sample survey. Although it was difficult to reach any conclusions when only fourteen households had responded, some tentative conclusions were reached.

Question number 1 (a copy of the questionnaire and covering letter is contained in Appendix 2) draws the distinction between, on the one hand, constant use of the same place ("all of the time") and, on the other hand, first choice settlement ("most of the time") and second choice settlement ("sometimes"). The distinction appears to have been lost on some of the respondents, for they completed both "all of the time" and "most of the time" columns. Those who did perceive the distinction appeared either to patronise the same settlement constantly, or to have few second choice settlements. Question number 6 draws a more explicit distinction between first and second choice settlements, in terms of services. When second choice settlements were identified they were rarely in Northwestern Ontario, or even in the adjacent part of Northeastern Ontario, and it is inferred that the second choice settlements were places of former residence, or temporary residence connected with business or vacation. Similarly, question number 4, relating to the frequency of catalogue purchases, revealed that respondents

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[1] Further, if this non-response rate was encountered in connection with verbally administered questionnaires, a sampling fraction of ten per cent would be too high to allow adequate recall.

used catalogues at the same frequency for each item listed: there was little variation in frequency amongst items. The tentative conclusion was that there was little use of second choice settlements for goods and services; or, this form of questioning in a postally administered questionnaire does not elicit information on second choice settlement shopping.

Question number 2 seeks to elicit information on patronage motivation. Responses fell into two classes: some respondents understood the question to mean "why did you buy the item?" not "why did you buy the item in the settlement you have named?", thereby illuminating the inadequacy of the sequence of question wording; other respondents, interpreting the question in the way it was intended, provided similar responses for each item. The tentative conclusion reached was that, in the projected sample survey, it would be possible to restrict the number of items for which patronage motivation data would be sought.

Sundry observations, based on returns, included the following: the term ethnic group required elaboration; the wordings of questions 15a and 15b were too complex; and the income bands of 15a and 15b were too small in extent while the range of specified income bands was too limited.

The coincident pilot sample survey of Red Rock aimed primarily to test the response rate to a verbally administered questionnaire of a ten per cent systematic sample of households, drawn from the preliminary list of federal electors in Red Rock.[1]

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[1] Issued in early May, 1968, on the basis of house-to-house visitation by a pair of enumerators.

The preliminary list of federal electors identifies all those eligible to vote: citizens of Canada and landed immigrants who are citizens of the United Kingdom. The addresses of the electors are given, together with occupation, so that members of the same household may be readily grouped. The 432 households identified for Red Rock constituted the sampling frame from which was drawn, from a starting point randomly selected within the first ten households listed, a systematic sample of forty-three households. As the households are arranged by street on the electoral list, and sequentially along streets, systematic sampling from this frame provides a certain amount of stratification which makes the sample more representative than a simple random sample (F. Conway, 1967, pp.128-129).

Of the forty-three households designated as sample units, eight non-responses were recorded: of these, two dwellings could not be located at all, two families were on vacation for an extended period, and four families refused. Of the thirty-five positive responses, twenty-three were contacted at the interviewer's first visit, eleven at the second visit, and one at the third visit. This evidence, together with Conway's (1967, p.138) recommendation, was taken as a basis for a maximum of three calls (that is, first call and two re-calls) as standard practice for the projected sample survey. The relatively high rate of response confirmed verbal administration of the questionnaire as the method to be adopted in the projected sample survey.

In view of the known provision for exclusion of individuals, and therefore of at least some households, from the federal roll, and in view of a subsequent calculation that yielded a figure of 517 households for Red Rock, the preliminary federal electoral roll was

rejected as a sampling frame for the projected survey.

The secondary aim of the pilot sample survey was to determine the validity of research goals; to test question wording and sequence, and adequacy of interviewer directions; and to isolate problem areas. (A copy of the questionnair and the letter of identification carried by the interviewer and to be shown on demand is contained in Appendix 3).

In question numbers 1 and 6 the respondent was asked for information on the last purchase (or visit) and his generalisation of his regular behaviour. The sequence of "last buy" "usually buy" for each item produced little variation and it may be that the answer to one was influenced by the answer to the other. More variation resulted from the sequence adopted in question 6.

Question number 2 aimed at isolating a generalised statement of patronage motivation. From the responses it was decided that patronage motivation should be keyed to specific items; and the repetition of responses to the second part of question number 3 indicated that only one or two items should be examined for patronage motivation in the projected sample survey.

No respondent appeared to have bought a variety of items by catalogue in the six-month period preceding this pilot study, although some respondents may have purchased a number of closely related items that could be summarised under a general term, such as clothing, or household supplies. Thus, it was decided that in the projected sample survey the time period would be shortened and an array of broad classes of item provided.

It appeared that the amount of detail requested in question number 7 would be unnecessary. Other sundry conclusions reached

were that: the form of 9a and b was too complicated for the interviewer and respondent, and would generate problems at the analysis stage; a $1,500 income band was too narrow, and the range of the incomes specified should be extended; and the information on summer cottages and length of residence there would not be useful for purposes of analysis because the few respondents with summer cottages had established them close enough to their permanent residences to allow them to patronise their usual outlets.

The Sample Survey

For the purpose of discussion the decisions and procedures involved in the sample survey of consumers in Northwestern Ontario have been classified into six main issues and they are discussed in the following order: (1) sample size, (2) sampling frame, (3) the questionnaire, (4) the administration of the questionnaire, (5) response rates, and (6) data generation.

1. Sample Size

The pilot sample surveys did little to indicate precisely what minimum size of sample would be appropriate. In general, they did indicate that because of the problem of non-response and of the necessity for one, possibly two, recalls, the sample size should be as small as possible.

It is possible to estimate, on the basis of pilot sample survey results, the size of sample required for a given level of accuracy (Gregory, 1963, pp.84-85); but this method seems to be applicable only to situations involving a single line of inquiry.

In exploratory studies (and the present study is very much an exploratory study) it is not clear if it is valid to infer the sample size required for the whole study on the basis of the sample size required for a small part of it. The writer does not feel that it is valid.

Some guide may be obtained from similar studies. R.A. Murdie (1965, p.215) in analysing the differential space preferences of Old Order Mennonite farm-households and "modern" Canadian farm-households, in Waterloo County, Ontario, employed a sampling fraction of *circa* twenty-five per cent to yield two samples each containing ninety-five units. J.R. Tarrant (1967), on the other hand, employed a ~~sampling fraction~~ stratified sample of ~~four per cent~~ in a more general examination of consumer behaviour in Eastern Yorkshire, England. For the purposes of this sample survey it was decided to use the sampling fractions adopted by Berry *et al.* (1962, p.68, footnote 7) in their study of consumer behaviour in Southwestern Iowa, U.S.A.:

(i) Dispersed population

10 per cent random areal sample of rural families

(ii) Nucleated population

(a)	Centres of 150 household (or less)	10% of families
(b)	Centres of 150-450 household	8% of families
(c)	Centres of 540-2,000 households	6% of families
(d)	Centres of 2,000-5,000 households	4% of families
(e)	Centres of 5,000 households (or more)	1% of families

Berry *et al.* appear to be equating families with households, and in this study the number of households in a centre is inferred from either known or calculated numbers of families, while households and readily identifiable dwelling-units are taken as being synonymous.

Thus the terms family, household and dwelling-unit are equated in this study. The advantage of a variable sampling fraction over a fixed one is that it provides the bases of inference about the behaviour of clusters of population as well as of the behaviour of the whole population in a study area, although the sampling fractions specified for small centres do not yield a large enough sample for many of the desired stratifications.

The sampling fractions, specifications of household ranges, and ranges of sample size employed in this study are set forth in Table 2.1. The ten per cent sampling fraction for dispersed households was retained.

TABLE 2.1

NORTHWESTERN ONTARIO SAMPLE SURVEY:

SAMPLE SIZES FOR CENTRES

S.F.*	Centre Sizes	Sample Sizes
10%	2 - 149 households	1 - 15 households
8%	150 - 449 households	12 - 36 households
6%	450 - 1,999 households	27 - 120 households
4%	2,000 - 4,999 households	80 - 200 households
1%	5,000 households	100 - households

*Sampling Fraction

To determine the number of units required to constitute the sample population of each centre the total number of households was obtained by dividing the 1967 assessed population of the centre[1] by

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[1]Data supplied by Ontario Department of Municipal Affairs.

either the mean family size given by the 1966 census for that centre or by the mean family size given by that census for the district within which the centre was located (Appendix 4). In smaller unincorporated centres, for which assessed population data were unavailable, the total number of households was enumerated in the field.

2. Sampling Frame

a) Areas of dispersed population

The primary sampling units were the geographic townships. The interviewer numbered on a map the first ten dispersed and isolated dwellings he encountered, on the road he happened to be on, after crossing a township line. One of these ten dwellings was selected by random sampling and constituted the first unit of the sample for that township. Thereafter, the interviewer travelled every road (surfaced and unsurfaced) in the township, in a haphazard fashion in that it was left to the interviewer's discretion as to what road to take at intersections, and every tenth dwelling was selected for inclusion in the sample and the interview conducted at the time of selection. In the cases of non-contact on first call, interviewers recalled if conditions permitted. On crossing another township boundary the process was repeated.[1] This sampling procedure may be termed systematic areal sampling and it ensures a measure of stratification of the sample. The repetition of the procedure for each township increases the random element in the total sample.

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[1] The location of each interview was marked and numbered on a township plan, if available, or on the largest scale of topographic map available (either 1:50,000, or 1:250,000); and the lot and concession numbers were entered on the questionnaire, as were township names and identifying numbers.

Thus, theoretically, sample values are valid for townships and aggregates of townships. Nucleations of two dwellings or more were treated as centres and to determine the existence and extent of nucleations a maximum separating distance of one tenth of one mile was adopted (as in the survey of business establishments).

b) Population centres

i) For incorporated centres the total number of households calculated on the basis of the assessment data was accepted: there was no field count of dwellings. Within municipal boundaries every nth dwelling-unit (at the appropriate sampling interval) from a randomly selected starting point was drawn into the sample. In the case of nucleations outwith municipal boundaries (Jumbo Gardens, for example), the distance test was performed and the dwellings treated as nucleations or as dispersed settlement. The location of each interview was marked on a map and numbered; and on each questionnaire that number was repeated and the address noted.

ii) For unincorporated centres a field count of dwellings and the distance test were performed. In the frequent absence of large scale maps and lack of street names, interviewers prepared field sketches of the centres to aid in subsequent location of the places at which interviews took place. The procedure of selection of sample units corresponded with that for incorporated centres.

For both types of centre the pattern of street coverage was haphazard; and recall was more comprehensive than for the isolated dwellings.

It should be noted that the results obtained in this study might be better than those obtained by Berry *et al.* (1962) in that the sampling employed here is systematic and has built into it an

element of stratification; whereas Berry *et al.* employed a random areal sample, which apparently does not include an element of stratification.

3. The Questionnaire

In view of the poor response to the postally administered questionnaire it was decided to collect the desired data by means of investigators calling upon the respondents selected in the sampling procedure. As it was planned to utilise a large number of relatively unskilled investigators and as it was planned that the data from different interviews would be treated in comparable ways, it was necessary to provide some instrument by means of which reliable and valid data could be obtained: reliable in the sense that repetition of the same question in different interviews yielded results that were consistent, and valid in the sense that the results of each question related to the research objectives.

There were two possibilities: either the respondent could be asked to complete a series of questions on a schedule given to him by the investigator and with either no assistance, or varying degrees of assistance, given to him by the investigator; or the investigator could verbally administer to the respondent a series of questions set forth on a schedule. The first possibility was rejected, without being tested in the field, on the ground that the respondent would probably require or request assistance in completing the schedule and that there would be unspecifiable variation in the degree and nature of investigator participation; and on the ground that the duration of each application of the schedule would be shortened -- and thus the duration of the whole sample survey -- if the investigator asked the respondent a series of questions and recorded his

responses. Moreover, the adoption of a procedure in which the investigator wrote on the schedules would reduce the possibility of illegible responses and would allow the utilisation of a schedule bearing notations for direct conversion to computer cards. It was felt that the array of computer numbers on any page would have an adverse affect on the respondent in that he might feel inadequate if not asked to utilise them in completing the schedule; and, if he was asked to utilise them, considerably more directions would have to be included on the schedule, and even then these might be misunderstood.

Therefore, it was decided that the investigator would verbally administer a series of questions provided on a schedule. This schedule could be constructed in two main ways: either, a series of general questions could be provided and the investigator instructed to elicit the required information by inquiry and discussion, without adherence to the precise wording of the question; or, the investigator could be instructed to utilise only the words provided on the schedule and not to depart from them. Arguments may be advanced in favour of both procedures.

The former procedure has the advantage that if the respondent does not understand the question, it may be rephrased or elaborated upon. Moreover, the investigator will be using his own words, within limits, and the interview may assume the characteristics of a conversation and put the respondent more at ease. This procedure requires, however, that the investigator has a thorough knowledge of the objectives of the research and an accurate perception of what is required for each question. In addition, each investigator must perceive the responses as being compatible with

his perception of requirements. As it was planned to utilise the services of a large number of young (seventeen-eighteen years old) investigators it was felt that it would place an undue burden on them to place them in a situation where the onus was on them to devise forms of question to elicit information. Moreover, because most respondents were likely to be older than the investigators there was little likelihood of conversational and informal interviews being conducted. If this procedure were rejected, therefore, little would be lost.

The latter procedure has the advantage that there is little variation in the posing of the question, if the investigator adheres to the wording given. Some variations amongst respondents' perceptions of the same question are unavoidable: due to variations in accent, voice levels, and tones amongst investigators; and due to the same investigator's variations in speech at different interviews. The principal disadvantage arises if the respondent does not under- the question was worded. To reduce this misunderstanding to a minimum great care has to be taken in the wording of each question, possible areas of difficulty identified or anticipated, and elaborations and clarifications of questions provided on the schedule for use by the investigator if the need arises.

On grounds of the nature and number of the investigators, the appearance of the schedule if the computer card numbers were included, and the length of the schedule, it was decided to provide precisely-worded questions; to instruct the investigators to adhere to the wording provided; to simplify the questions to ensure maximum respondent comprehension; to provide elaboration; and to attempt to eradicate as much variation of investigator speech as possible.

Given the precise nature of the schedule, it might be more correctly referred to as a questionnaire.

The questionnaire utilised to elicit information in a field study generally represents a compromise between the information required by the research objectives of study and a set of other factors which may be identified as time, cost, the characteristics of the investigators and respondents, and the possibilities of data analysis. Also, its final form will reflect a compromise between generally accepted practices and the conditions introduced by the nature of the area under study and its inhabitants.

As the objectives of this study were exploratory rather than directed towards verifying a particular hypothesis, beyond a certain level there was some latitude in the precise nature of some of the data collected. (On the other hand, there was no latitude in the nature of the data collected for the Ontario Regional Development Branch.)

The two pilot sample surveys were useful in testing sequence of sections, sequence of questions within sections and the wording of questions. In addition, the responses to the questions posed in the pilot sample surveys provided an opportunity to review the value of pursuing particular research objectives.

An increasing number of studies in geographical research utilise questionnaires in the data collection phase. Rarely, however, is a copy of the questionnaire utilised included within the publication reporting on the research. R.S. Thoman and M.H. Yeates (1966) reporting on their study of the Georgian Bay Area (Ontario) do not include one; nor does B.J.L. Berry, and his various associates, in reporting on studies of consumer behaviour in Southwest Iowa (1962, 1967). J.R. Tarrant (1967), in his methodological study of

retail distribution in Eastern Yorkshire (England) does not include a copy of the questionnaire; however, he does provide the framework for the questionnaire, does provide a representation of the information which may be derived from the questionnaire, and within the body of the discussion does discuss the phrasing of some of the questions. L.P. Bucklin (1967), on the other hand, includes a copy of the questionnaire utilised in a sample survey of the shopping behaviour of residents in the metropolitan Oakland area, California.

The studies by B.J.L. Berry *et al.*, L.P. Bucklin, and J.R. Tarrant served as guides in the design of the questionnaire. More general directions are available: in the works of F. Yates (1960), L. Festinger and D. Katz (1953), and J.N. Jackson (1963). The directions contained within these works fall aptly into the description provided in one of them (Cannell and Kalm, p.333): "Much of the available literature [on questionnaire design] consists of rules of thumb, presented as lists of "do's" and "dont's" for the ... questionnaire framer".

The first problem in designing a questionnaire is that of dealing with respondent motivation: how does the investigator stiumulate the respondent at first contact so that the respondent will be prepared to continue with the interview and exert himself to provide accurate and consistent answers? C.F. Cannell and R.L. Kalm (1953, pp.326-380) have suggested that the two strongest initiators of respondent motivation are financial and scientific interest. In other words, the respondent agrees to participate in the interview because payment will result or because he is deeply interested in contributing to the advance of knowledge in particular branch of research. This type of initiation is most common in connection

with laboratory interviews and testing in psychological and sociological research. It is less common in field surveys in geographical research and, in these cases, at the outset of the interview the investigator himself has to attempt to relate the interview to the respondent's goals. The Manitouwadge pilot sample survey provided an opportunity to test a method of initiating response by relating the study to the respondent. There had been frequentcomplaints of poor service provision in Northwestern Ontario and the letter accompanying the postal questionnaire exhorted the respondent to complete the questionnaire so that the results of the survey could be used to gain an overall picture of under-provision of services and be used in the planning of better facilities. In other words, there was the suggestion -- not untrue -- that in completing the questionnaire the respondent would be contributing towards an improvement in the level of goods and services available to him. The very low rate of return of questionnaires in the postal pilot sample survey may be ascribed to a number of factors over which the success or failure of response initiation would have no control but it was decided that in the final questionnaire the attempt to initiate a response would be low-key, not imply the promise of remedial action and rely upon the implication of the scientific worth of the study (Appendix 5: introductory statement of the investigator, p.2 of the questionnaire). It is short and clearly-stated: the investigator introduces himself and identifies the sponsoring body; and he briefly indicates the purpose of the interview, outlines what is involved and guarantees anonymity.

Once the respondent has a clear idea of what is involved it is necessary that the questions asked by the investigator may be

perceived by the respondent as being germane to the stated purpose. It is especially imperative that the first series of questions may be perceived by the respondent as being clearly in line with the stated purpose. This guiding principle, then, determined the overall sequence of questions: questions related to the obtaining of goods and services were asked in the first part of the interview; and questions of a more personal nature in the second part, after a certain amount of rapport had developed between investigator and respondent and after the investigator had gained the respondent's confidence.

Within these two sets of questions, certain acknowledged guide-lines relating to sequence were accommodated. Questions of fact should precede, and if possible lead into, questions of opinion and generalisation; easy questions should precede more difficult questions.

The actual questionnaire utilised in the field differs from the example contained in Appendix 5. The former was printed on foolscap-sized paper rather than on quarto-sized paper for three reasons: the larger page size allowed a greater degree of spacing between instructions and questions on the one hand and the places for recording responses on the other; the larger page size meant that fewer pages in total were needed to contain all of the questions and thus the investigator had less pages to turn during the interview, preserving a greater degree of continuity and providing less distraction for the respondent; and the fewer pages meant that the questionnaire at the outset would appear to the respondent to be less bulky and would not have an adverse affect upon the possibilities of the respondent agreeing to answer.

The first section of the questionnaire (questions 1-10) is concerned with consumer behaviour, whereas the second section (questions 11-48) is concerned with obtaining data on the household to be used for stratified analyses.

More specifically the first section consists of questions relating to: place of last and most purchase of apparel goods and goods of staple household consumption; place of last purchase of bulky household goods and potentially high cost goods; and place of last and most purchase of an array of services. Last purchase questions precede most purchase questions: fact before generalisation. Patronage motivation questions (2 and 4) succeed questions of fact and generalisation. The first section is concluded with an attempt to discover seasonal variation in place visited to shop (9i and 9ii), and reasons for it (10iii); seasonal variation in mode of transport (9iii and 9iv); and seasonal variation in frequency of shopping trips (10i), and the reasons for it (10ii).

Within this first section there are two direct attempts to validate responses. Firstly, information is collected on catalogue purchases by specified item and subsequently information is collected on catalogue purchases in general. Secondly, if seasonal variation in the place of purchases is found to exist, there should be discrepancies, for some items at least, between places of last and most purchases, because "most" should include summer and winter behaviour, whereas "last" should include only summer behaviour. (The sample survey was conducted in late summer.)

In detail the second section consists of questions seeking to elecit information on age, ethnicity, occupation, employment, and income, all of which might be useful in stratifying sets of distances.

(The second section also attempts to elicit information required by the Ontario Regional Development Branch: on migration, education and training, and work place.) In addition, it includes questions attempting to establish respondents' perceptions of the duration of winter.

The experience of attempting to analyse manually the comparatively small numbers of questionnaires completed in the courses of the pilot sample surveys indicated that analyses of the larger number of returns involved in the sample survey would have to be computerised. In turn, this led to information loss: because of the maximum number of twelve spaces in each of the eighty columns on a computer card and the concomitant necessity to accommodate variations in responses within this range.

The most striking effect of this limitation was the necessity to arrange all of the settlements of Northwestern Ontario into sets: in conducting an interview at one location only eight other locations may be listed to include the array of places the consumer might visit; three spaces are occupied by "catalogue", "not applicable", and "other". Further, it is not feasible to provide the most likely other eight locations for each place surveyed: there is no economy of scale and time in questionnaire printing; and distance generation would be too complex. Thus, on the basis of reconnaissance field work performed in the summer of 1967, Northwestern Ontario was divided into five primary settlement sets so that each set consisted of larger settlements whose locations held out the possibility of interaction amongst them. The first set included Port Arthur and Fort William and included the larger settlements along the north shore of Lake Superior (Highway 17); the

second set was drawn from the settlements located on the northern route to the east (Highway 11); the third set from the Trans-Canada Highway (17) to the west of the Lakehead; the fourth set from those settlements along Highway 11, again to the west of the Lakehead; and the fifth, from the Red Lake area. Those nucleated settlements omitted were allotted to the most appropriate secondary set (Appendix 6). (The array of settlements shown in the questionnaire in Appendix 5 constitutes primary settlement set number one.)

The last issue in respect of the questionnaire concerns wording. The general principle of anticipating the range of vocabulary and comprehension of the whole sample was closely adhered to: questions were short, direct and simply-worded. The problem of ambiguity, where the question-setter means one thing and the respondent is allowed so much latitude that his reply could mean any one of a number of things was anticipated and eradicated as far as possible. J.T. Tarrant (1967, p.12) feels that the term groceries is too wide a term and prefers to specify certain kinds of groceries, namely sugar and bread, as reliable indicators of place of grocery purchases. The term may be too wide for use in Tarrant's study area (Eastern Yorkshire, England), and may be too wide for studies concerned with intra-urban movement in both Europe and North America; but, given the North American pattern of the weekly-shopping trip, the term does not appear too wide in a rural-urban or inter-urban context; although the writer concurs with the exclusion of bread from groceries. Tarrant's criticism of the use of the term clothing is taken and a greater degree of specificity, men's coat for example, is aimed for in this questionnaire. It has to be borne in mind, though, that increasing specificity as to item serves to reduce the response rate to a particular question. At

times the reduction can render a sample size, adequate in general terms, inadequate in terms of specific questions.

4. Administration of the Questionnaire

Administration of the questionnaire to the sample chosen, over an area as wide as the study area posed the problem of balancing the necessity of a consistent and high standard of interviewing with the requirement of completing the sample survey within a short enough time period for the results to be comparable, especially in view of the possibility of seasonal variation in consumer behaviour.

To shorten the time period a team of Lakehead University students, trained by the writer, was heavily supplemented by Grade Thirteen High School students, supervised indirectly by the writer through the considerable efforts of their geography teachers.[1] High School teams were assigned the settlements in which their schools were located; the writer's team surveyed all other nucleations, and the areas of dispersed population. The whole sample survey was conducted during August and September of 1968.

Prior to the administration of the questionnaire the writer attempted to ensure high response rates. Elected officials of municipalities were contacted, the purpose of the sample survey was explained to them and they were requested to encourage their constituents to participate. In addition radio and television stations, and newspapers, were requested to announce the imminence of the sample survey, explain its purpose and assure the population

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[1] The writer's team was composed of: Miss Susan Haglund and Miss Kim Lawer; and Messrs. John Bishop, Johann Goertz, John Lemmon, Ronald Lysen, Russel Paul and Frederick Pukila. Details of High School participation are noted in Appendix 7.

that it was a bona fide survey.

To avoid variations in interviewer coding, for all questions where some subjectivity might be called for interviewers merely recorded answers and the writer classified and coded the answers when all completed questionnaires had been sent in. In the process the writer rejected all completed questionnaires of a dubious nature.

5. Response Rate

The sample sizes designated for each settlement and the number of responses obtained, after rejection of some questionnaires at the coding stage, are detailed in Appendix 4.

The response rate is here defined as the percentage of the sample size constituted by the number of responses utilised in analysis. The overall response rate was 84.1 per cent but, as there were fluctuations, this figure requires more detailed scrutiny. The mean response rates within the classes of fixed sampling fractions were as follows:

Class	f*	No. of centres	Mean response rate
1	1%	2	97.5%
2	4%	2	75.5%
3	6%	13	72.6%
4	8%	11	80.3%
5	10%	32	88.9%

*f: sampling fraction.

These class mean response rates also require greater scrutiny for, apparently, the largest and smallest size-classes have the higher rates, whereas the medium size-classes have less satisfactory rates. The class 1 mean rate is a reasonable expression of the variation within the class and the excellent response rate here might be attributed to the familiarity of Lakehead respondents with sample

surveys and the work of Lakehead University. The mean rate for the fifth class conceals a range of response rate, from twenty-seven per cent (Armstrong) to one hundred per cent. The low Armstrong response rate is, perhaps, symptomatic of certain turbulent events in that settlement, which preceded but were not connected with this sample survey. Similarly, the residents of Upsala had experienced a trying time in the summer of 1968 when Upsala became a refuge for transient "hippies". Although several one hundred per cent response rates are recorded in the fifth size class, it should be noted that very often this represents, for example, three successes out of three selections. Only one refusal would have reduced the rate to 66.6 per cent.

The other three classes all record a response rate in the seventy to eighty per cent range and, but for a few extreme scores, the means appear to be representative of the scores in the classes. Atikokan (35%) may be singled out as having the most disappointing response rate. The reasons for non-response are illuminating:

Refusals	20
Language barrier	2
Interviewee incapable	1
No contact	20
Total	43

Firstly, the sample size, obtained by dividing the 1967 assessed population by the 1966 census mean family size figure and taking six per cent of the result, was set at 103. The households in Atikokan were not enumerated in the field but sampling was conducted by drawing every seventeenth household from a randomly selected starting point. The sum of responses (36) and non-responses

(43) is 79. The 103-79 discrepancy may be attributed to one or all of the following factors: faulty sampling procedure (miscounting, omission of streets, misrecording of non-responses); decline in population from 1967; or unrepresentative nature of mean family size figure. In several other cases (Jellicoe, Minnitaki and Upsala, for example) there are discrepancies between the number of households expected on the basis of calculation and the number of households determined by enumeration in the field, usually taking the form of an expected value higher than the actual value. In the cases of unincorporated settlements the root of the discrepancy may be in the difference between what the Ontario Department of Municipal Affairs considers any settlement to be and the procedure utilised here to define a settlement. The general effect of the proved discrepancies is to suggest that response rates may be better than the figures would suggest as in many cases the number of households expected may be too high.

In any event it remains to compare the response rates obtained and as qualified with those obtained in other studies, as a guide to the validity of the samples.

Bucklin (1967, pp.13-16) reports that he obtained 506 usable interviews out of a designated sample of 600, employing five call backs and replacement: a response rate of 83 per cent. Conway (1967, pp.138-139) reports on a sample survey with an 89.1 response rate; and shows that if it is assumed that those not interviewed have the same characteristics as those interviewed, the results are very similar. Tarrant (1967, pp.10-11) gives no information on non-response, but does report the surprisingly low figure of only five refusals out of 465 interviews. Jackson (1963, p.69) reports

on a study with a non-contact rate of 10 per cent and a refusal rate of 5.5 per cent for those contacted: an overall response rate of 86.5 per cent. Jackson, however, does not evaluate the validity of this response rate.

In both Bucklin's and Tarrant's studies replacement for non-contact was employed. In the present study it was not employed, for either non-contact or refusal, or for the other reasons for non-response such as language barriers or incapabilities of interviewees. Replacement would have been difficult to implement when so many interviewers were engaged in the sample survey. It is assumed that the characteristics of those households for which no data were obtained are similar to those for which data were obtained.

6. Data Generation

After coding, the information contained in each questionnaire was transferred to two IBM punch cards. The information recorded under the serial number identifies the nucleation or township from which the questionnaire originated, the appropriate settlement set, and the interviewer. This allowed intermingling of cards and various areal aggregations and divisions.

Data output occurred in two main forms:

a) Places visited

For each areal unit (township, unincorporated nucleation, or incorporated nucleation the responses to each choice in each question were totalled. For the two major areas of dispersed population the data for each township were aggregated and utilised in this form. Thus information on the total number of, for example,

the Rainy River dispersed respondents travelling to Fort Frances for men's work clothes is available.

Data were not aggregated for nucleations: they were retained in the form, for example, nine respondents in Red Rock travel to Port Arthur to purchase womens' coats.

b) Distances travelled and time taken

The distances involved in obtaining items were obtained in two ways.

i) Dispersed Population

Desire line maps were constructed, from the questionnaire, for each item investigated: straight lines were drawn between respondent location and place of purchase. This meant that trips to places not included in the array of a settlement set and recorded under other could be represented. For each item the actual distance travelled by each consumer was obtained by measuring the most likely route[1] the consumer would have followed with the aid of a measuring wheel and 1:250,000 map sheets (except for Neebing and McIntyre Townships, for which 1:50,000 map sheets were used). Distances were obtained in miles, to one decimal place.[2] Thus for each item

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[1] The "most likely route" is generally the shortest route, except where this involves a disproportionate mileage over unpaved roads and a longer route would reduce this. The subjective element was reduced by the writer's observations of most heavily travelled roads, and by haphazard inquiry. Moreover, there is frequently little or no choice as to route.

[2] Where the item is obtained from an incorporated nucleation, distance measurement, residence to nucleation, is halted at the municipal boundary: because there is no information as to where *within* the municipality the item is obtained; and residents of a nucleation obtaining an item there are judged to travel no distance.

there is a set of distances from which various summary measures may be obtained.

Because travel time may be more important than travel distance, and because of variations in road surface and legal speed limit in the rural areas, travel times for each respondent's trips for every item were calculated. (The extent of hard-surfaced and gravel roads in the Lakehead area are given in the first Chapter and road types are shown in Chapter 4). Maps of the areas include information on the types of road surfaces. These maps were updated by the writer in the summer of 1968 to show paved roads and gravel roads; and in addition zones of permitted maximum speed were mapped. In the measurement of distances, the proportions of each journey travelled over roads with 60, 50, 40, and 30 miles per hour speed limits were obtained and the distances converted to times on the assumption that drivers travel up to the speed limits. (Haphazard observations over a number of years confirm that most do.) There was one exception. In the absence of a posted speed limit drivers may drive at fifty miles per hour. The writer's own experience on gravel roads led him to believe that it is difficult to maintain this average speed on gravel roads; therefore, the writer timed a number of rural residents over these roads and concluded that an average speed of forty miles per hour was a more realistic basis for converting distance to time in respect of the gravel road sections of journeys. This speed was utilised in the conversion.

Because distances were not generated from the existing punch cards, separate punch cards bearing the distance data were prepared. In view of punch carding costs, and time, distance data for last purchase information were entered only when there appeared

to be severe discrepancies between last purchase and most purchase sample means. (Sets of times were not entered due to high correlations between them and distance sets.) In addition data to be used in analyses of distance had to be entered on this second set of cards.

ii) Nucleated Population

With intra-nucleation distances being judged as nil, the location of each respondent is not unique; it is shared with all other respondents in the nucleation. There is no need, then, to measure the distances travelled by each respondent: they may be generated by applying the data of the original punch cards to matrices containing the distances, between all nucleations in a particular settlement set. The distance matrix for the first settlement set is shown in Table 2.2

TABLE 2.2

SETTLEMENT SET 1: DISTANCE MATRIX*

		1/1/1**	1/1/2	3/1/5	1/1/7	1/1/0	1/1/6	2/1/6	2/1/4	1/1/6
No.	Name	P.A.	F.W.	K.F.	Nip.	Sch.	T.B.	Mar.	Man.	R.R.
1	P.A.	0.0	2.9	17.6	59.2	113.6	121.6	171.2	224.0	56.0
2	F.W.	3.8	0.0	16.0	67.2	121.6	129.6	179.2	232.0	64.0
3	K.F.	17.6	16.0	0.0	--	--	--	--	--	--
4	Nip.	59.2	67.2	--	0.0	54.4	62.4	112.0	164.8	11.2
5	Sch.	113.6	121.6	--	54.4	0.0	8.0	57.6	110.4	65.6
6	T.B.	121.6	129.6	--	62.4	8.0	0.0	49.6	102.4	73.6
7	Mar.	171.2	179.2	--	112.0	57.6	49.6	0.0	60.8	123.2
8	Man.	224.0	232.0	--	164.8	110.4	102.4	60.8	0.0	176.0
9	R.R.	56.0	64.0	--	11.2	65.6	73.6	123.2	176.0	0.0
10	Cat.	0.0	0.0	--	0.0	0.0	0.0	0.0	0.0	0.0

*In miles

**Code nos.

and all distance matrices are listed in Appendix 6. Thus if four Nipigon respondents report purchase of an item in Port Arthur, four values of 59.2 miles are entered in that item's distance set; and if three Terrace Bay respondents report purchase of that item in Schreiber, three values of 8.0 miles are added to the distance set. This method allows sets of distances for each item to be generated for each nucleation and for aggregates of nucleations. Moreover, as the distances are generated from the original punch cards, it is possible to cross-analyse the distances with any other data on the original punch cards.

The procedure is rapid but it does involve an information loss: there is no way of including distances travelled to settlements other than those specified in the array of a particular settlement set, because no distance can be entered in the matrix for other settlements visited.

Two entries in Table 2.2 require elaboration. Port Arthur respondents purchasing items in Fort William are credited with travelling 3.8 miles, and Fort William respondents purchasing items in Port Arthur 2.9 miles; yet travel between the two cities involves most respondents in crossing a common municipal boundary. The distances are mean distances and they were established by laying a grid of points over the built-up areas of both cities and measuring the actual distance involved in travel from each point to the boundary-crossing by the most likely route, aggregating the distances, counting the number of points, and dividing each sum by the appropriate number of points. In a sense the points are treated as dispersed households and the mean travel distance involved in reaching the boundary of the city visited is being calculated.

Thus each Port Arthur consumer is judged to travel 3.8 miles in reaching the boundary when involved in purchasing items in Fort William; and each Fort William consumer 2.9 miles, when purchasing an item in Port Arthur. The difference between the two means reflects differences in the extents and dispositions of the two built-up areas relative to the common boundary and crossing-points.

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CHAPTER 3

SERVICE PROVISION

INTRODUCTION

In formulating the inquiry into the nature of service provision in Northwestern Ontario it was decided to seek evidence of a hierarchical system of service centres. If evidence of a hierarchical system is lacking, then the alternative of arrangement of service centres on a continuum must be accepted. Marshall (1969, p.23) has classified the nature of the evidence required to verify the existence of an ideal system of central places:

(1) spatial interdependence of centres

(2) functional wholeness of the system

(3) discrete stratification of centrality

(4) interstitial placement of orders

(5) incremental baskets of goods

(6) a minimum of three orders

(7) a numerical pyramid in order membership

The first two categories of evidence require information on consumer behaviour and this is provided subsequently in Chapters Four and Five. Of the other five categories, as Marshall notes (pp.24-27), the sixth is essential only if one wishes to make broad generalisations about the nature of service centre systems; and the fourth and seventh categories are appropriate inquiries once a

system has been postulated.

Attention must be focused firstly on the third and fifth categories listed, that is on the associated requirements for discreteness of orders and increments of baskets of goods. This dual requirement, under ideal conditions, may be traced to the following statement by Christaller (1966, p.64):

> In the lowest type, the H-place ... only those types of goods which have a range of 3 km. (more exactly, of less than 4 km.) will be offered. Let us assume there are ten types of goods which have such a low range.... In the M-type of central place, there are offered the first ten types of goods which are offered in H, and also all central goods with a range of 4-7 km. .... If there are 30 types of goods in this group, then a total of 40 types of goods are sold in M. In the A-places central goods with a range of 7-12 km. are added. If we assume that there are 50 types of goods with this range, then 40 plus 50, or 90 types of goods are marketed in A.

Although it is not clear that Christaller is referring to the actual types of goods, rather than to numbers of goods, Berry and Garrison (1958a, p.146) clarify the issue:

> The model states that central places belong to one or another of class subsets. Each class possesses specific groups of central functions and is characterized by a discrete population level of its centres.
>
> Note that (1) classes are arranged one to another in a hierarchy such that the central places of functionally more complex classes possess all the groups of functions of less complex classes plus a group of functions differentiating them from places of less complex classes ...

Even Christaller (1966, p.69) felt that his requirements were rather strict when seeking evidence of a hierarchical system in a real context; and similarly Marshall (1969, p.23) warns against "extreme rigidity of interpretation" in applying his own

seven categories.

The crucial issue for the present study is the extent to which the characteristics of service provision in Northwestern Ontario may depart from the general principles of the central place model before the postulated existence of a hierarchical system of service centres is called into question.

In terms of discreteness of classes, examination of Christaller's evaluation of his own preliminary findings in Southern Germany is unrewarding (1966, pp.184-185):

> This M-place [lowest grade of central place Christaller recognised] is characterized mainly by its weekly markets, and still further by having other central institutions: a vital statistics office ... and sometimes a veterinarian, a dentist ... and perhaps a co-operative, a loan office branch.... The M-places nearly always have a railroad station ... and there are almost always important crossroads.... The next type of central place [A-place] is characterized by having a lowest court ... and, frequently, railway crossroads.

The key words here are "mainly", "sometimes", "perhaps", "nearly always", "almost always", and "frequently". It would be difficult to place these terms on a scale of relative frequency. It would be even more difficult to assign numerical values, such as percentages, to them; and also difficult to reach agreement on the percentages chosen.

Marshall (1969, p.25) has expressed the notion of discreteness of orders in another way: under ideal conditions within-order variation amongst functions is absent, and the incremental baskets of goods will produce variations in functional complexity between orders. Applying this notion to actual situations, between-order variation should exceed within-order variation; thus the

necessity for selection of critical values is avoided and evidence of hierarchical structuring rests on comparative grounds.

Evidence of a hierarchical system of service centres in Northwestern Ontario is sought by examining the service equipment of the centres at both aggregate and elemental levels. Because of shortcomings in the analyses possible and, additionally, to suggest a complementary or alternative method, relationships between service equipment and consumer behaviour are proposed and consumer behaviour is analysed at both elemental and aggregate levels.

ANALYSIS OF SERVICE EQUIPMENT

Aggregate Level

The field survey of the study area, carried out in the summer of 1968 and described in the first section of Chapter Two, revealed sixty-seven locations possessing two or more establishments providing goods or services or both.

Sixty-four functional types of establishment were recognised and these are ordered (Appendix 9) by treating them as attributes (either a location has one or more establishments of a functional type, or it does not) and arranging them in descending order of attribute frequency of occurrence. Thus the most frequent occurrence is filling station (forty-nine occurrences out of sixty-seven locations), while several functional types are the attributes of only single locations (for example, bookstore and pet shop).

Berry and Garrison (1958a) rank-ordered fifty-two functions (variates) on the basis of predicted thresholds by relating the number of establishments of a functional type located in a centre

to that centre's population. Thereafter, they grouped the functions into classes and these classes of functions were found to be significantly associated with classes of central place. Because the population of a place in Northwestern Ontario is more likely to be related to a primary resource such as forestry or mining than to the employment opportunities afforded by fulfilling the demands for service of an externally located population and because it is extremely difficult precisely to define the total population served by a service centre in a frontier area, the use of population data has been rejected in the present study. Further, because most sophisticated techniques developed since Berry and Garrison's use of the threshold population (1958a) have either utilised populations of centres or total populations served, any attempts to order and group functional types and order and group service centres in this study are less sophisticated than those employed in areas more closely resembling the ideal conditions of the central place model. Occurrences of functional types (attributes) have been plotted against numbers of establishments of functional types and the pattern is shown in Figure 3.1. If clear breaks could be perceived in the pattern, any groupings of functional types could be tested against groupings of service centres in an attempt to verify the validity of the service centre groupings: for example, if visual examination of the pattern of functional type-establishment relationships revealed two clear breaks and therefore three groups of functional types and if visual examination of service centre-functional type relationships revealed, similarly, two clear breaks and therefore three groups of service centres, a basis would be provided for comparing groupings of functional types with groupings of service centres. Only one clear break is apparent, however: in the vicinity of 35 (abscissa), 250 (ordinate). Therefore, there

appears little chance of deriving valid groups of functional types for comparison with orders of service centre.

Scott (1964) differentiates classes of service centre, on the basis of the relationship between numbers of functions and numbers of functional units, by examining the log-linear pattern and searching for breaks of slope. In Figure 3.2 sixty-seven service centres are represented in a semi-logarithmic graph by plotting the number of functional types each possesses (abscissa) against the number of establishments each possesses (ordinate). (Only forty-one dots appear on the graph as twenty-six service centres share the same co-ordinates with at least one other service centre). If Figure 3.2 is examined visually for breaks in slope in the pattern, only one break of slope (and therefore two regimes) appears to exist. As this break of slope does not occur at the end of a scale phase on the ordinate axis it is not felt that the scale properties of the graph paper are inducing the perception. Because Johnston (1965) claimed that Scott had transformed a linear relationship on an arithmetic graph into an exponential relationship on a semi-logarithmic graph, the points in Figure 3.2 were plotted on arithmetic graph paper (Figure 3.3, from which Port Arthur and Fort William are omitted due to scale difficulties). Visual analysis of this pattern (Figure 3.3) is difficult, but there appear to be four different sets of relationships: one extending to 10 (abscissa), 20 (ordinate); one from 10, 20 to 27, 43; one from 27, 43 to 39, 93, and one in the locus of Dryden, Kenora, Fort Frances.

To aid clarification of the issue, the procedures of Murdie (1965) and Thoman and Yeates (1966) may be examined. Murdie (1965, p.214) utilised "well-documented breaks [in the numbers of

central functions possessed by places] to identify a hierarchy of central places" in his study area of Southwestern Ontario. It is not clear if Murdie used actual numbers of central functions provided by other studies to identify his classes of central places, or whether he used general principles enunciated in those studies in analysing his numbers of functions. In any event, examination of the pattern of numbers of central functions (Murdie, 1965, Table 1, p.214) reveals that the breaks between all classes of central place exceed any single break within classes; although three of the six classes of central place each contain only one member. Thoman and Yeates (1966, Table 11.10, p.66) recognise seven classes of central place on the basis of "evaluation of field data". Precisely how the classes were determined is not clear but it appears that ranges in four types of data were considered: number of central functions, number of establishments, number of wholesale firms, and population. It is worth noting that the ranges in numbers of central functions and establishments fully occupy the scales within which they lie, for example 1-9, 9-24, 24-50 -- central functions. (In passing, it may be noted that whereas Murdie adopted a 2-12 range in central functions for classification of hamlets, Thoman and Yeates adopted a 1-9 range.)

If Figure 3.2 is re-examined from the standpoint of clusterings of numbers of functional types, three groups are apparent: 1-39 functions; 46-49 functions; and 57-60 functions. If the group encompassed by 1-39 is examined from the standpoint of the relationship between functions and establishments, it may be that there is at least one break within it, at 10 functions. Data on consumer behaviour, however, indicate that there are two systems of service

centres represented in Figures 3.2 and 3.3: one focusing on Port Arthur and Fort William (hereafter referred to as the Lakehead system); and the other focusing on Winnipeg, which is outwith the study area but which provides goods and services for the western part of it. From an analysis of consumer space preferences in respect of selected goods and services most service centres can be satisfactorily assigned to either of the two systems. Atikokan, Ignace and Upsala are located on the common peripheries of the two systems and consumer space preferences in respect of all goods and services were examined to assign Atikokan and Upsala to the Lakehead system and Ignace to the Winnipeg system. In the absence of precise consumer behaviour data for four centres, assignment to systems was based on relative positions and subjectively obtained data: Stevens to the Lakehead system; and Wabigoon, Savant Lake and Hudson to the Winnipeg system.

The thirty-three centres comprising the Lakehead system have been abstracted from Figure 3.2 and are re-represented in Figure 3.4. On the basis of numbers of functional types four orders[1] of service centre may be recognised in the Lakehead system:

Order	Range in No. of Functional types	No. of centres in Order
1st	1 - 8	20
2nd	13 - 17	4
3rd	24 - 39	7
4th		No representative
5th	57 - 60	2

---

[1] In the present study the terms "order", "grade", "rank" are equated when qualifying "service centre". A number of "grades", "orders", "ranks" are taken to constitute a "hierarchical class system".

Examination of Figure 3.4 reveals that the minimum number of functional types separating two orders (six, between orders 1 and 2) exceeds the maximum number of functional types separating any two members of a particular order. The existence of a fourth order, with no representatives in the Lakehead system, is inferred from the details of the Winnipeg system. It is held that no fourth order centre has developed in the Lakehead system partly because of the close juxtaposition of two fifth order centres and partly because of the absence of sizeable areas of dispersed population other than at the Lakehead.

The thirty-four centres held to constitute the Winnipeg system (or more accurately, that part of the Winnipeg system located in the study area) have also been abstracted from Figure 3.2, and they are re-represented in Figure 3.5. On the basis of number of functional types, four orders of centre (the first three of which are held to correspond to the first three orders of the Lakehead system) may be recognised in the Winnipeg system:

Order	Range in No. of Functional Types	No. of centres in Order
1st	2 - 13	23
2nd	17 - 21	5
3rd	30 - 36	3
4th	48 - 49	3

Examination of Figure 3.5 reveals that except in one case (a within-order separating distance of four functional types -- between Rainy River and Red Lake in the 3rd order; and a between-order separating distance of four functional types -- Nestor Falls, first order, from Sioux Narrows, second order) the distances between orders exceed all distances between the members of any order.

Both Lakehead and Winnipeg orders have been established primarily by an examination of crude numbers of functional types. It is necessary to seek additional information to verify these orders.

Firstly, the range of numbers of establishments associated with the numerical ranges of functional types possessed by orders may be examined (Table 3.1).

TABLE 3.1

FUNCTIONAL TYPE-ESTABLISHMENT RANGES

Lakehead System

Order	Functional Type Range	Establishment Range
1st	1 - 8	2 - 16
2nd	13 - 17	19 - 27
3rd	24 - 39	42 - 93
4th		No representative
5th	57 - 60	789 - 793

Winnipeg System

Order	Functional Type Range	Establishment Range
1st	2 - 13	2 - 16
2nd	17 - 21	21 - 31
3rd	30 - 36	52 - 83
4th	48 - 50	149 - 238

In the Lakehead system, except for one case, all of the gaps between orders exceed any gaps within orders, the exception being the gap of three establishments between the first and second orders, which is exceeded twice within the first order and once within the second order. Also, it is exceeded within the third order. In the Winnipeg system the gap between the second and third orders exceeds any gap between centres within those orders;

but the internal gap within the fourth order exceeds the gap between third and fourth orders, and the gap between first and second orders is exceeded by gaps within the first order. For both systems, however, where establishment ranges are suspect, functional type ranges provide separation.

Secondly, the relationship between numbers of functional types and numbers of establishments within classes may be examined by means of the product moment coefficient of correlation (Table 3.2).

TABLE 3.2

FUNCTIONAL TYPE-ESTABLISHMENT CORRELATION

Order	Lakehead System	Winnipeg System
1st	r = + 0.92*	r = + 0.95*
2nd	r = + 0.95*	r = + 0.54
3rd	r = + 0.95*	r = + 0.94
4th		r = - 0.58
5th		

*Significant at 0.05 level.

Whereas the first three orders of the Lakehead system each contain enough members to establish significantly high correlations, only the first order of the Winnipeg system contains enough members for a significant correlation coefficient to be established. Accordingly, only those regression lines calculated on the basis of significant coefficients of correlation have been entered in Figures 3.4 and 3.5. These regression lines demonstrate the tendency of numbers of establishments to vary with numbers of functional types.

As it might be possible to derive other orders of settlements

and to establish their validity with equally high correlation coefficients, and as significant correlation coefficients are lacking for some of these orders, other evidence must be sought to support the particular grouping of centres into orders presented here.

Elemental Level

Two subjective tests were employed by Scott (1964). The first of these, the frequency of distribution of centres within classes, does not appear to the writer to be very useful in the context of the present study: because the number of settlements in Northwestern Ontario may be added to by the development of a primary resource such as iron ore or subtracted from by the depletion of a primary resource such as gold, the number of service centres at any one point in time does not necessarily accord with the pattern of supply of, and demand for, services. But the second, the characteristic functions of each order, appears more promising. It should be emphasised that merely to identify functions, or functional types, as being typical of a group or order subsequent to classification of centres into groups by another method provides no necessary validation of the groups. More analysis is required: for example, if after the typical functions of orders have been identified some relationship amongst the groups of functions consistent with theory and other empirical findings can be shown to exist, then the original classification of centres into orders may be validated. In the present study relationships within and between orders will be examined. Scott designated functions as typical of a group if they were common to at least seventy-five per cent of that group's centres. For the purpose of the present study, in general terms it seems

reasonable to adopt a critical level below one hundred per cent, as no one functional type is characteristic of all centres in the study area, reflecting in part the classificatory problems of the functional typology (dealt with in Chapter 2). Because some of the orders of centres involved in the present study consist of only two, or three, members, a standard critical level for all classes is undesirable. Thus for classes consisting of three centres or less a critical level of one hundred per cent is employed; for all other classes, the critical level is seventy-five per cent. On these bases the characteristic functional types of the two sets of orders have been determined (Appendices 10 & 11).

The information contained in Appendix 10 may be summarised in two ways. Firstly, the numbers of functional types characteristic of each order in the two systems may be compared (Table 3.3).

TABLE 3.3

NUMBERS OF FUNCTIONAL TYPES CHARACTERISING ORDERS

Order	Lakehead System	Winnipeg System
1st	0	0
2nd	11	12
3rd	24	23
4th	--	39
5th	52	--

There is a close numerical correspondence between the first three orders of the two systems. No functional type is numerous enough to characterise either first order, although general store comes closest to the critical level (75%) in both cases. The close numerical correspondence between the two second order groups and

the two third order groups belies a qualitative diversity. Fifteen functional types are represented by the centres of the second orders of both systems and only eight of these are common to both orders; while eighteen functional types out of twenty-nine are common to the centres of both third order groups. Given the lack of fourth order representation in the Lakehead system and the lack of any intermediate centres between the fourth order centres of the Winnipeg system and Winnipeg itself, it is to anticipated that the array of functional types present in one order of one system will differ from the array of functions present at the same level in the other system. For example, the array characteristic of the Winnipeg fourth order centres may be shared by the fifth and third order centres of the Lakehead system.

Central place theory holds that a centre of any class (other than a centre of the lowest class) possesses the service equipment identical to a centre in the adjacent lower class plus additional service equipment that places it in the next higher class.

TABLE 3.4

NUMBERS OF FUNCTIONAL TYPES DIFFERENTIATING ORDERS

Order	Lakehead	Winnipeg
5th/3rd	31	--
4th/3rd	--	16
3rd/2nd	14	14
2nd/1st	11	12

Examining the Lakehead system (Table 3.4), as no functional type characterises the first order centres all functional types typical of second order centres must be taken as setting off second

order centres from first order centres. Further, whereas the difference between the numbers of functional types characteristic of second and third order amounts to fourteen, the third order group of centres possess only thirteen functional types which are not also possessed by the second order group: the variety store functional type is characteristic only of the second order group. As there is no representative of the fourth order in the Lakehead system, it may be noted only that both Port Arthur and Fort William possess all of the functional types characteristic of the third, second and first orders in the Lakehead system (Appendix 10).

Examining the Winnipeg system (Table 3.4), again all functional types of the second order differentiate it from the first order, which is characterised by no functional type. According to theory, the third order in this case should possess eleven functional types differentiating it from the second order (twenty-three minus twelve); but fourteen functional types differentiate the third order from the second order as the second order is characterised by three functional types -- meeting halls, motels and appliance stores -- not typical of the third order. The fourth order possesses sixteen functional types which differentiate it from the third order and, moreover, the fourth order possesses all functional types characteristic of the third orders and lower (Appendix 10).

It should be noted that the Lakehead system second order functional type uncharacteristic of the third order is characteristic of the fifth order and that the three functional types characteristic of the Winnipeg system second order, but not its third order, are characteristic of its fourth order.

Comparing both systems from the standpoint of the actual

functional types that set the same higher orders apart from the same lower orders, considerable discrepancy is discovered. As no functional type characterises the first order, the eight functional types out of the total of fifteen common to the two second orders must be taken as setting the second order off from the first. Out of the nineteen functional types represented by both sets of third order differentiating functional types, however, only four are common to both sets of differentiators. Again, this may be interpreted as a qualitative difference between the two systems introduced by the lack of a fourth order in the Lakehead system and, possibly, by the lack of a fifth order in the Winnipeg system.

It should be noted that the fourth most numerous attribute of centres in the entire study area, general store, is characteristic of no order in either system. Similar to Berry and Garrison's (1958a) finding, general store seems to exist as a functional type apart.

The lack of a functional type, or types, characteristic of both first orders has already been partially attributed to the classificatory scheme utilised. Had establishments been divided into functional units, functions characteristic of the first order could have been obtained. More serious from the standpoint of theory is the failure of higher orders comprehensively to include all of the functional types of adjacent lower orders. As in both cases the failure resides in the third orders, it may be that no distinct class of second order centres exists, in either system, and that the second and third orders should be amalgamated.

Such an amalgamation of orders would substitute a numerical progression of 2:0:11:20 for the present 2:0:7:4:20 (Lakehead system) and a numerical progression of 3:8:23 for the present 3:3:5:23

(Winnipeg system), and would better accord with the principle of increasing numbers of centres with declining order. It has been pointed out, however, that the study area is a frontier area characterised by areas and settlements of economic specialisation. It is certain that some settlements have part of their economic activity oriented towards providing goods and services for dispersed populations; some for other nucleated populations; some for, primarily, their own populations; and some for transient populations. It is shown subsequently that Port Arthur, and Fort William, Fort Frances, Emo and Rainy River are focii for dispersed populations seeking goods and services (Chapter 4), that Port Arthur, Fort William, Geraldton, Nipigon, Red Lake, Dryden, Kenora and Fort Frances serve other nucleated populations, and that places such as Atikokan and Manitouwadge serve primarily their own populations (Chapter 5). Thus it is not reasonable to expect that the principles of theory will always precisely apply. Moreover, quantitative and qualitative data on centres' service equipment should not be analysed in abstraction: it should be qualified by information on consumer behaviour. Accordingly any amalgamation must await this information.

ANALYSIS OF CONSUMER BEHAVIOUR

Elemental Level

It may be proposed that if hierarchical classes of service centre are recognised, on a basis of service equipment, consumer behaviour should take on some aspects of a hierarchical class system. More specifically, within classes of service centres there should be

consistency in terms of the proportion of the centres' populations obtaining an item within the centres in which they reside. Moreover there should be clear differences between the proportions of populations served by the home settlements of one order and those served by the home settlements of a higher- or lower-ranked order. If clear differences do not exist, at the very least within-order proportion variation should exceed between-order proportion variation. As stated the proposition is valid, but consumer behaviour may not verify it because an equally valid proposition may be advanced: that the populations of service centres of one order, familiar with that order's service provision and with their expectations raised by it, travel to centres of a still higher order; with the custom thereby lost to their home settlements being replaced by travel from settlements in lower orders of service centre or by travel on the part of dispersed populations. In addition, this effect may be differential *within orders* due to the irregular locational patterns of service centres and due to qualitative differences within orders identified on a quantitative basis: for example, Nipigon is tentatively designated as a third order centre in the Lakehead system, as is Manitouwadge. If the first proposition is valid, it is to be expected that Nipigon and Manitouwadge will supply similar proportions of their own populations with similar goods. Because Nipigon is much closer than Manitouwadge to the fifth order centres at the Lakehead, Nipigon may supply a significantly lower proportion of its own population with some goods than does Manitouwadge, retaining third order status by attracting the deficit from second order centres such as nearby Beardmore or Red Rock. Thus data on consumer behaviour may be

used to verify the existence of discrete hierarchical classes (first proposition). If consumer behaviour data do not verify the orders, however, this does not necessarily mean that discrete orders of service centre do not exist (alternative proposition).

Analysis of variance allows comparison of more than two sample means to determine whether within-group differences are greater or smaller than between-group differences. Because the writer knows of no equivalent and standard test for sample proportions, less satisfactorily, true proportions of home-town and out-of-town purchases, of each item, have been calculated at the 0.05 level, for the two systems.

To establish the range within which lies the true proportion of consumers purchasing items in the home settlement, the standard error of the proportion for each item's sample proportion may be obtained (Ferguson, 1959, pp.128-129):

$$sp = \sqrt{\frac{pq}{N}}$$

where sp is the standard error of the proportion

p is the proportion buying within the home settlement

q is the proportion buying outwith the home settlement

and N is the number of consumers reporting travel for item purchase.

For example, twenty-six Geraldton households (86.6%) purchase men's work clothing in Geraldton; and the remaining four of the sample (13.4%) travel to other service centres. Converting the percentages to proportions and substituting

$$sp\ 0.866 = \sqrt{\frac{0.886 \times 0.134}{30}}$$

$$= \underline{\underline{0.0616}}$$

The standard error of the proportion at the 0.05 level is obtained by multiplying 0.0616 by 1.96, = 0.1207, which is converted to the standard error of the percentage of multiplying by 100, = 12.07. Rounding out the standard error to one decimal place, the percentage of the whole Geraldton population purchasing men's work clothes in Geraldton is 86.6% +/-12.1%, that is between 74.5% and 98.7%. It is this range (and other ranges similarly calculated) that is represented in Figure 3.7.

Ideal patterns of range relationships, to support the first proposition have been constructed, (Figure 3.6).

In Figure 3.6A similar percentages of consumers purchase item x in the service centres (orders 3-1) in which they reside. In Figure 3.6B, equal percentages of consumers residing in third and second order classes of service centre purchase item y in those centres, but a substantially lower percentage of consumers purchase item y in the home settlements of the first order. In Figure 3.6C the percentage of home settlement purchases for item z varies closely with order of settlement. Clear breaks are apparent in Figures 3.6B and C and it may be asserted that between-order variation exceeds within-order variation.

The range of the true percentages of home-town purchases, for each item, is shown in Figure 3.7 (Lakehead system) and Figure 3.8 (Winnipeg system).[1] For each item the ranges in home-town

[1] The ranges for both systems' first order service centres are not shown, as percentage of home service centre purchases could not be generated due to most of these service centres falling within secondary settlement sets for data collection purposes.

purchases are grouped according to the groupings of towns determined by service equipment analysis. (Data are in Appendix 8.)

Examining the Lakehead system, only two clear breaks between classes of centre are apparent: between Port Arthur and Fort William (fifth order centres) and between Atikokan and Marathon (both third order centres) -- optometrist. In part the lack of clear breaks between the ranges of members of adjacent orders may be a function of increasing range-width in the lower classes caused by a decreasing sample size, notwithstanding the increasing sampling fraction. In other words, at the level of the individual settlement, the increases in sampling fractions have been insufficient to offset decreasing sample sizes and to prevent increasing range-width.[1] Variability in range-width within orders should not be affected to the same extent by the sampling fraction -- although it may be affected by varying response rates -- and therefore variation within orders may be usefully examined. Clear breaks within orders may be determined by visual analysis, but where upper and lower ends of ranges with widely differing sample percentages slightly overlap, statistical testing for significant difference is required. Either of two tests may be employed: standard error of the difference between two proportions, or a form of the chi-square test. Both tests were applied to a haphazardly chosen sample of pairs of ranges with very fine overlaps and both tests yielded similar results. The special case of chi-square employing the two-by-two (fourfold) contingency table was used to test for significant differences between

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[1] Because of a degree of consonance between classes of service centre and the population classes specifying sampling fraction, range-widths tend to be similar within classes of service centre.

pairs of dichotomously arranged frequency distributions (Ferguson, 1959, pp.168-169):

$$X^2 = \frac{N\,(AD - BC)^2}{(A + B)\,(C + D)\,(A + C)\,(B + D)}$$

where

	1st Settlement	2nd Settlement	
no. of home-town purchases =	A	B	A + B
no. of out-of-town purchases =	C	D	C + D
	A + C	B + D	N

The relationship between the Terrace Bay and Marathon ranges in respect of jewellery purchases provides an illustration:

Terrace Bay (TB) residents purchasing jewellery there is

56% +/- 19.5%

Range is 36.5% - 75.5%;

Marathon (M) residents purchasing jewellery there is

21.4% +/- 15.2%;

Range is 6.2% - 36.6%

The two ranges overlap by 0.1%.

Substituting the actual values in the contingency table,

	TB	M	
no. of home-town purchases =	14	6	20
no. of out-of-town purchases =	11	22	33
	25	28	53

and in the formula,

$$X^2 = \frac{53\ (308 - 66)^2}{462{,}000}$$

$$= 6.71.$$

With df = 1, at the 0.05 level, X^2 must be equal to or greater than, 3.84, for assertion of significant difference. In this case $X^2 = 6.71$, therefore there is a significant difference between the Terrace Bay and Marathon patterns of home-town and out-of-town jewellery purchases.

Ferguson (1959) mentions no limiting conditions deeming this form of the chi-square test inappropriate but the writer feels that it would be inappropriate to apply it to the small numbers involved in the home-town and out-of-town purchases of the consumers residing in service centres of the second order.

Thus visual perception of difference between the individual service centres of the fifth and third orders has been supplemented by testing for significant differences when clear differences are not readily apparent. Similarly the visual perception of differences *within* classes has been supplemented by testing for significant differences.

Between- and within-order variation is compared in the following way. Seven settlements are considered to comprise the third order. Pairing each service centre with every other service centre in the third order, for each item, there are twenty-one opportunities for either no significant difference to exist or for a significant difference to exist. Two service centres are held to comprise the fifth order and for each item there is only one opportunity for significant difference. Considering the fifth

and third orders together, there are thus twenty-two opportunities for either similarity or difference within the orders.

With two members in the fifth order and seven members in the third order, there are fourteen opportunities for significant difference between the two orders. Those differences perceived visually have been supplemented by testing for significant difference. The pattern of differences is set out in Table 3.5 and to compare within- and between-order differences, the numbers of differences have been converted to percentages, for each item.[1] For example, seven out of twenty-two opportunities for difference in the level of home-town purchases of refrigerators are occupied (within-order variation equals 31.8%, Table 3.5); and six out of fourteen opportunities for difference in the level of home-town purchases of men's work clothes are occupied (between-order variation equals 42.9%, Table 3.5).

Only four items demonstrate no within-order variation in consumer behaviour and only one item demonstrates no between-order variation. For twenty-two out of twenty-three items, despite some considerable within-order variation, there is a greater level of between-order variation than within-order variation. Thus, on the basis of home-town and out-of-town purchases involving travel, it may be asserted that Port Arthur and Fort William have been validly grouped over an order comprising Atikokan, Geraldton, Nipigon, Schreiber, Manitouwadge, Terrace Bay and Marathon. Two qualifications are necessary. Firstly, other groupings of these nine

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[1] The item teenage girls' clothes has been omitted from the analysis as numerical values for some of the third order centres are low.

TABLE 3.5

LAKEHEAD SYSTEM: FIFTH AND THIRD ORDER DIFFERENCES

	Within-Order				Between-Order		
Item	5	3	5 + 3	%	5 & 3	%	Excess % $\frac{BO}{WO}$
MWC	0	0	0	0	6	42.9	42.9
WS	0	2	2	9.1	12	85.7	76.6
TGC	--	--	--	--	--	--	--
CC	0	0	0	0	7	50.0	50.0
MC	0	9	9	40.9	14	100.0	49.1
WC	1	7	8	36.4	14	100.0	63.6
Dru	0	6	6	27.3	8	57.1	29.9
Groc	0	0	0	0	1	7.1	7.1
Meat	0	0	0	0	0	0	0
TV	1	1	1	4.5	3	24.4	19.9
Ref	1	6	7	31.8	10	71.4	39.6
Fur	1	10	11	50.0	9	64.3	14.3
Wa	0	1	1	4.5	8	57.1	52.6
Jew	1	5	6	27.3	13	92.9	65.6
Car	0	6	6	27.3	8	57.1	29.8
FD	0	5	5	22.7	8	57.1	34.4
MSp	0	14	14	63.6	14	100.0	36.4
Dent	0	8	8	36.4	10	71.4	35.0
Law	0	10	10	45.5	14	100.0	34.5
CI	0	11	11	50.0	8	57.1	7.1
Opt	0	8	8	36.4	14	100.0	60.6
Bank	0	2	2	9.1	4	28.6	19.5
Hos	0	6	6	27.3	8	57.1	29.8

centres might be possible. For example, Marathon could be omitted from the third order, and placed in the second order, and a satisfactory result might be obtained. Or, for another example, Geraldton could be placed in the fifth order, or in a fourth order, and a satisfactory result might still be obtained. Secondly, that this result is satisfactory is perhaps a result of comparing separated orders (fifth and third) rather than adjacent orders (fourth and third). No fourth class of service centre has been postulated for the Lakehead system, but one has for the Winnipeg system. Therefore, the fourth and third orders of the Winnipeg system are compared.

Analysis of service equipment suggested that the fourth and third orders of the Winnipeg system each contained three members. Therefore there are three opportunities within each order for significant differences to exist and nine opportunities for significant differences to exist between the orders.

At the visual level only one clear break is apparent: the percentages of residents of fourth order centres purchasing cars in their home centres are consistently higher than the percentages of second order centre residents purchasing cars in their home centres. Testing for the significant difference between sample percentages adds to the visually perceived difference and the results are set out in Table 3.6.

The results are less conclusive than those for the Lakehead system. For one item, men's shoes, there is neither within- nor between-order variation; and, whereas for thirteen items between-order variation exceeds within-order variation, for eight other items within-order variation exceeds between-order variation.

TABLE 3.6

WINNIPEG SYSTEM: FOURTH AND THIRD ORDER ELEMENTAL DIFFERENCES

	Within-Order				Between-Order		Excess %	
Item	4	3	4 + 3	%	4 & 3	%	$\frac{WO}{BO}$	$\frac{BO}{WO}$
MWC	3	0	3	50.0	0	0.0	50.0	
WS	1	0	1	16.7	0	0.0	16.7	
MS	0	0	0	0.0	0	0.0		
TGC	-	-	-	--	-	--		
CC	0	0	0	0.0	2	22.2		22.2
MC	1	0	1	16.7	3	33.3		16.6
WC	0	0	0	0.0	5	55.6		55.6
Dru	1	0	1	16.7	3	33.3		22.2
Groc	1	0	1	16.7	2	22.2		5.5
Meat	1	0	1	16.7	1	11.1	5.6	
TV	0	0	-	0.0	3	33.3		33.3
Ref	0	1	1	16.7	4	44.4		27.7
Fur	0	0	0	0.0	8	88.8		88.8
Wa	1	0	1	16.7	2	22.2		5.5
Jew	1	0	1	16.7	3	33.3		16.6
Car	0	0	0	0.0	9	100.0		100.0
Fd	1	2	3	50.0	4	44.4	5.6	
MSp	0	2	2	33.3	5	55.6		22.3
Dent	2	2	4	66.7	5	55.6	11.1	
Law	0	2	2	33.3	9	100.0		66.7
CI	2	2	4	66.7	2	22.2	44.5	
Opt	2	2	4	66.7	6	66.6	.1	
Bank	2	0	2	33.3	3	33.3	38.9	
Hos	2	3	5	83.3	4	44.4		

Moreover, in some cases the excess between-order variation is derived from significantly *higher* percentages in the *third* order, in the case of bank, for example, where all three third order centres have significantly higher proportions of home-town patronage than Fort Frances in the fourth order. It is difficult to accommodate such anomalies in statistical analysis because, in investigating within-order variation, the null hypothesis is, and logically should be, non-directional; and in investigating between-order variation the null hypothesis is formulated on a non-directional basis because of the possibility of the equal validity of the two propositions which have been postulated. Even without this anomaly, it is not clear whether a ratio of thirteen to eight is sufficient for assertion of discreteness of orders. It is asserted here that examination of home-town and out-of-town purchases at the elemental level *tends* to suggest discreteness of orders,but the evidence is not conclusive.

The analysis of service centre equipment demonstrates that out of wide arrays of functional types only some functional types may be described as either characterising an order or setting one order off from another. This feature was ascribed, in part, to the use of the functional type classification. It may be ascribed also to erroneous classification of centres or to the lack of discrete orders in reality. The analysis of consumer behaviour at the elemental level suggests clearly discrete orders over part of the Lakehead system, in a comparison of non-adjacent classes, and tends to suggest discreteness of orders over part of the Winnipeg system. No analysis of home-town and out-of-town purchases is possible at the level of individual settlements, however, to test the discreteness of third order and second order classes, because of the low number of respondents in each settlement.

Aggregate Level

Analysis of deliberately-selected elements of consumer behaviour is inconclusive. It may be argued, however, that service centres possess overall attractiveness, importance, or drawing power and that anomalies of consumer behaviour, more readily apparent at the elemental level, destroy perceptions of the overall relationships between service centres.

Accordingly, the totals of home-town and out-of-town purchases of sixteen goods (farm machinery is omitted) have been separately aggregated; as have the totals of home-town and out-of-town consumption of eight services (Appendix 11). The home-town and out-of-town aggregates have been utilised in further analysis, rather than the means, because of the reduction in the size of the standard error of the percentage achieved by working with the large aggregated figures.

The sample percentages of home-town aggregate consumption of goods and services, together with the appropriate standard errors of the percentage, for the service centres of all orders in the Lakehead system except for the lowest order, are listed in Table 3.7.

The ranges of the true percentages of home-town consumption are portrayed in Figure 3.9, where the vertical bars are numbered to correspond with the numbers used in Table 3.7. Several clear breaks are apparent in Figure 3.8 and in cases of dubious overlap of two ranges the chi-square test has been used to detect significant differences.

TABLE 3.7

LAKEHEAD SYSTEM: AGGREGATE CONSUMER BEHAVIOUR

	Goods			Services		
Service Centre	% HT	+/- sp (.05)		% HT	+/- sp (.05)	
1 Fort William	84.4		1.7	92.6		1.8
2 Port Arthur	92.6		1.1	93.3		1.5
3 Atikokan	72.1		3.9	71.8		5.6
4 Geraldton	77.0		3.5	63.0		5.3
5 Nipigon	57.9		4.4	43.1		6.6
6 Schreiber	67.3		6.5	44.0		9.0
7 Manitouwadge	59.7		4.3	67.2		6.0
8 Terrace Bay	53.9		4.8	57.0		6.6
9 Marathon	51.5		4.6	54.0		6.0
10 Longlac	42.7		6.5	47.6		8.7
11 Red Rock	24.4		4.1	30.1		6.2
12 Beardmore	41.8		7.8	25.2		8.9
13 Nakina	25.0		7.4	2.3		10.1

Examining firstly aggregate consumer behaviour in respect of goods, if the groupings of service centres are maintained and within- and between-order differences are sought on the basis of a non-directional hypothesis (X^2 = 3.84 +, for significant difference, df = 1, at 0.05), there appears to be evidence to support the notion of hierarchical classes (Table 3.8).

TABLE 3.8

LAKEHEAD SYSTEM: AGGREGATE DIFFERENCES

	5th and 3rd Orders		3rd and 2nd Orders	
	Between-Order	Within-Order	Between-Order	Within-Order
Goods	100%	81.8%	100%	78.6%
Services	100%	77.3%	85.7%	81.5%

Grades five and three exhibit a between-order level of difference of 100 per cent and a within-order level of difference of 81.8 per cent; and grades three and two exhibit a between-order level of difference (100%) that exceeds the within-order level (78.6%).

If, however, the initial groupings based on service equipment are ignored and a directional hypothesis adopted (X^2 = 2.71 +, for significant difference, df = 1, at 0.05), the rank-ordering or settlements based on the functional type-establishment relationship may be adjusted in terms of similarity or difference in percentage of home-town consumption (Table 3.9, where 0 represents no difference and 1 a difference, between any pair).[1]

The overwhelming impression gained from considering Figure 3.9 and Table 3.9 in conjunction is that of difference in aggregate consumer behaviour. Three of the four orders of service centre, recognised on a basis of service-equipment, are destroyed. Port Arthur serves a significantly higher percentage of its own population than does Fort William. Similarity in level of good provision is limited to pairs of service centres: for example, Geraldton and Atikokan, Atikokan and Schreiber, Manitouwadge and Nipigon.

This apparently contradictory result is repeated when aggregate consumer behaviour in respect of services is examined (Table 3.7 and Figure 3.9). Maintaining the orders of service centres established by analysis of service equipment and applying a non-directional hypothesis, grades three and five exhibit a

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[1] This sytem of scoring and matrix construction is discussed in detail in Chapter 4.

TABLE 3.9

LAKEHEAD SYSTEM: DIFFERENCES IN AGGREGATE CONSUMER BEHAVIOUR - GOODS

		2	1	4	3	6	7	5	8	9	12	10	11	13
Fort William	2	-	1	1	1	1	1	1	1	1	1	1	1	1
Port Arthur	1		-	1	1	1	1	1	1	1	1	1	1	1
Geraldton	4			-	0	1	1	1	1	1	1	1	1	1
Atikokan	3				-	0	1	1	1	1	1	1	1	1
Schreiber	6					-	1	1	1	1	1	1	1	1
Manitouwadge	7						-	0	1	1	1	1	1	1
Nipigon	5							-	0	1	1	1	1	1
Terrace Bay	8								-	0	1	1	1	1
Marathon	9									-	1	1	1	1
Beardmore	12										-	0	1	1
Longlac	10											-	1	1
Red Rock	11												-	0
Nakina	13													-

between-order rate of difference of 100 per cent and within-order rate of difference of 77.3 per cent; and grades three and two exhibit rates of 85.7 per cent and 81.5 per cent (Table 3.8). Again there appears to be support for the existence of a system of hierarchical classes.

Ignoring the initial groupings and applying a directional hypothesis, the service centres may be rearranged in their rank-ordering (Table 3.10). Again the overriding impression is that of difference, not similarity.

The grades of the Winnipeg system provide a more satisfactory opportunity to test for discreteness in that there are three adjacent grades: fourth, third and second. The sample percentages, and standard errors, are set out, in aggregate, for goods and services in Table 3.11. The results of testing for discreteness, with non-directional hypotheses, are, however, contradictory (Table 3.12). Examining consumer behaviour in respect

TABLE 3.10

LAKEHEAD SYSTEM: DIFFERENCES IN AGGREGATE CONSUMER BEHAVIOUR - SERVICES

		1	2	3	7	4	8	9	10	6	5	11	12	13
Port Arthur	1	-	0	1	1	1	1	1	1	1	1	1	1	1
Fort William	2		-	1	1	1	1	1	1	1	1	1	1	1
Atikokan	3			-	0	1	1	1	1	1	1	1	1	1
Manitouwadge	7				-	0	1	1	1	1	1	1	1	1
Geraldton	4					-	1	1	1	1	1	1	1	1
Terrace Bay	8						-	0	1	1	1	1	1	1
Marathon	9							-	0	1	1	1	1	1
Longlac	10								-	0	1	1	1	1
Schreiber	6									-	0	1	1	1
Nipigon	5										-	1	1	1
Red Rock	11											-	0	1
Beardmore	12												-	1
Nakina	13													-

of goods, grades four and three appear to possess perfect discreteness (Table 3.12 and Figure 3.10); but, whereas the level home consumption within the third grade is higher than any level attained within the second grade, there is considerable variation within the second grade, enough to cause a rearrangement of rank-ordering within the second grade, under a directional hypothesis (Table 3.13). The fourth and third orders, however, appear to be validated. A much more distorted pattern emerges when services are considered. Within-order variation exceeds between-order variation (Table 3.12 and Figure 3.10) in both cases of non-directional testing, and a more marked rearrangement of rank-ordering results from pair-comparison under directional testing (Table 3.14). Table 3.14 may be interpreted in greater detail. It would appear that, in terms of service consumer behaviour, service centres 1, 2 and 5 constitute a clear grade. Fort Frances achieves a level of home-settlement

TABLE 3.11

WINNIPEG SYSTEM: AGGREGATE CONSUMER BEHAVIOUR

Service Centre	Goods % HT	+/- sp (.05)	Services % HT	+/- sp (.05)
1 Dryden	82.8	2.0	88.8	2.3
2 Kenora	85.1	1.8	87.6	2.3
3 Fort Frances	84.0	2.4	78.3	3.7
4 Sioux Lookout	75.1	4.1	64.7	6.6
5 Red Lake	74.6	4.5	83.4	5.5
6 Rainy River	71.4	4.9	45.6	7.8
7 Emo	49.0	7.8	48.9	10.6
8 Keewatin	25.4	4.1	27.8	6.0
9 Balmertown	38.0	5.9	39.5	8.3

TABLE 3.12

WINNIPEG SYSTEM: AGGREGATE DIFFERENCES

	4th and 3rd Orders		3rd and 2nd Orders	
	Between Group	Within Group	Between Group	Within Group
Goods	100 %	0 %	100 %	50 %
Services	66.7%	83.3%	77.7%	83.3%

patronisation significantly lower than Kenora and Dryden, but not significantly lower than Red Lake. Service centres 7, 6 and 9 constitute a clear grade, with Sioux Lookout in a clearly defined position between the rearranged grades four and three. Keewatin's position is difficult to interpret because of the lack of information on first grade service centres: either it falls between second and first grades, or it lies partially or wholly within the first grade -- according to this evidence.

TABLE 3.13

WINNIPEG SYSTEM: DIFFERENCES IN AGGREGATE CONSUMER BEHAVIOUR - GOODS

		1	2	3	4	5	6	7	9	8
Dryden	1	-	0	0	1	1	1	1	1	1
Kenora	2		-	0	1	1	1	1	1	1
Fort Frances	3			-	1	1	1	1	1	1
Sioux Lookout	4				-	0	0	1	1	1
Red Lake	5					-	0	1	1	1
Rainy River	6						-	1	1	1
Emo	7							-	1	1
Balmertown	9								-	1
Keewatin	8									-

TABLE 3.14

WINNIPEG SYSTEM: DIFFERENCES IN AGGREGATE CONSUMER BEHAVIOUR - SERVICES

		1	2	5	3	4	7	6	9	8
Dryden	1	-	0	0	1	1	1	1	1	1
Kenora	2		-	0	1	1	1	1	1	1
Red Lake	5			-	0	1	1	1	1	1
Fort Frances	3				-	1	1	1	1	1
Sioux Lookout	4					-	1	1	1	1
Emo	7						-	0	0	1
Rainy River	6							-	0	1
Balmertown	9								-	1
Keewatin	8									-

EVALUATION OF EVIDENCE

As conditions in reality are expected to depart from the mathematical regularities of the central place model, it becomes a subjective judgement as to how far the principles of the model may be distorted before the structural elements of the model may be judged atypical of an area. It is more convenient to consider distortion in relative terms, rather than absolute terms, because of inevitable disagreement over the levels of those absolute terms.

Analysis of service centre equipment and one aspect of consumer behaviour in the Northwestern Ontario study area, both at elemental and aggregate levels, yields results suggestive but not conclusive of a hierarchical class system of service centres.

Initial consideration of the relationship between functional types and numbers of establishments for the whole study area suggests a two-step hierarchy with Port Arthur and Fort William comprising the highest grade; with Dryden, Fort Frances and Kenora comprising another grade; and with all other service centres occupying a third and lowest grade spanning a wide array of complexity within which service centres appear to be arranged on a continuum.

Allocation of the service centres to one or other of two systems, identified on a basis of consumer movement, strengthens the impression of a step-like arrangement of service centres in classes.

At the elemental level, the adoption of 75 per cent and 100 per cent critical levels in determining the characteristic functional types of each grade yields results consonant with theory. It is true that no functional type characterises the first and lowest grade of service centre in the study area, but the lowest grade of service centre in Christaller's central place model, however, was not accorded full central place status. (Centres of the lowest grade were termed auxiliary centres and no immutable array of functions was prescribed for them.) In the study area, second and higher order grades do possess characteristic functional types; however, there is quite a high incidence of other functional types occurring within a grade but not frequently enough for these functional types also to be judged typical of that grade. Considering

only characteristic functional types on the other hand, while some grades fail comprehensively to include all of the functional types of lower grades, the departure from comprehensiveness is slight.

The formulation of a hypothesis concerning consumer behaviour, held to be consistent with the notion of discrete grades of service centre, yields results that tend to point in the direction of discrete grades of service centre. Comparison of between- and within-grade consumer behaviour at the elemental level is restricted to the two higher grades of each system, because of low values of n in the second grade. The three higher grades are compared at the aggregate level because of the higher levels of n resulting from aggregation of elemental values. The lowest grade is excluded from both levels of analysis because of the absence of the appropriate data caused by the combined procedure of settlement sets and computer analysis (Chapter 2).

Grades five and three in the Lakehead system appear to possess strongly discrete characteristics at both the elemental and aggregate levels, while grades three and two appear discrete at the aggregate level. The fourth and third grades of the Winnipeg system are discrete at the elemental level at a ratio of thirteen to eight but at the aggregate level, whereas goods exhibit much stronger between-order than with-order variation, the reverse is the case with services. This aggregate pattern is separated for the third and second orders. If, however, no distinction is made between goods and services, between-group variation does exceed within-group variation, for both the fourth and third grade and third and second grade comparisons.

It is concluded that this evidence is strong enough to

confirm the existence of a hierarchical arrangement of service centres. Only two of Marshall's categories, discrete stratification of centrality and incremental baskets of goods, have been analysed in detail. If, however, the existence of the two hierarchical systems is accepted, the sixth and seventh categories have been dealt with: five orders have been identified and the numerical progression in order membership exhibits irregularities. Because of the integral relationship between service centres and consumer travel behaviour, consideration of the degree to which service provision in Northwestern Ontario exhibits spatial interdependence of centres, interstitial placement of orders, and functional wholeness of the system is reserved until patterns of consumer travel behaviour have been described and analysed (Chapters 4 and 5).

CONCLUSIONS

The distribution of the orders of service centre in Northwestern Ontario is shown in Figure 3.11.

The Lakehead system, focused on the two fifth order centres of Port Arthur and Fort William, extends from Manitouwadge in the east to Atikokan and Upsala in the west. Fifty-two functional types characterise the fifth order, which is differentiated from the third order by thirty-one functional types ranging from specialised retail outlets such as jewellery store, sporting goods store and music store to specialised services such as undertaker, lawyer and veterinarian. Although Port Arthur and Fort William have almost identical population totals and correspondingly close numerical measures of service equipment, it is shown subsequently that Port Arthur is patronised to a greater extent than is Fort William (Chapters 4 and 5).

Seven third order centres exist in the system and while twenty-four functional types characterise the order fourteen functional types differentiate it from the second order. These differentiating functional types range from hardware store and apparel store to physician, beautician, high school and credit union. The economic bases of these third order centres vary markedly. Atikokan and Manitouwadge are primarily mining towns while Nipigon and Geraldton are more diversified, ranging over service provision, mining and forestry. Schreiber, only seventeen miles from Terrace Bay, is a railway town. The centres' populations also vary, from a high of 6,386 (Atikokan) to a low of 1,966 (Terrace Bay). Therefore, economic base and demographic diversity contrast with the similarity in service provision.

Four second order centres are recognised (Longlac, Nakina, Red Rock and Beardmore) and the order's eleven characteristic functional types, such as food store, hotel, filling station and barber shop, also differentiate it from the first order. The failure of the second order to include more members than the third order is mentioned earlier in this chapter as giving cause to doubt the validity of the second order. It is shown subsequently (Chapter 5) that Red Rock and Beardmore rely on Nipigon for some items and that Nakina and Longlac rely on Geraldton for some items. Moreover, the level of home town patronisation for goods and services exhibited by Red Rock and Beardmore is significantly lower than that of Nipigon. Similarly home town patronisation for goods and services by Longlac and Nakina is significantly lower than that of Geraldton.

No functional type characterises the first order, which contains twenty-three centres. Nine of these are located in the

area of dispersed settlement adjacent to Port Arthur and Fort William: from South Gillies in the south to Dorion in the north. The extent of their service roles may be judged from the evidence presented in Chapter Four. The remaining first order service centres either supply woods operatives or tourists or both.

The Winnipeg system focuses on the city of Winnipeg, which is located outwith Northwestern Ontario. Kenora, Dryden and Fort Frances constitute the highest order centres in the Northwestern Ontario sector on the Winnipeg system, which extends to Ignace and Savant Lake (Figure 3.11). The fourth order is characterised by thirty-nine functional types, of which sixteen differentiate it from the third order; and these range from laundromat, department store and credit union to lawyer, dentist and photographer. The economic bases of these three fourth order centres are very similar: pulp and paper, a service role for an adjacent dispersed population and for summer tourists and cottagers. Despite the similarities in service centre status and economic base, their populations differ in size, with Dryden being only two-thirds the size of Kenora.

There are three service centres in the third order (Sioux Lookout, Rainy River and Red Lake) and of the twenty-three functional types characteristic of the order, fourteen differentiate it from the second order: these range from beautician, apparel store and drug-store to high school, dry cleaner and furniture store. In Chapter Five it is shown that these third order centres do not exhibit the same dependency on fourth order centres in the system as do the Lakehead third order centres in respect of that system's fifth order centres. It may be tentatively suggested that once a third order resident has covered the distance to a fourth order centre he is as

well going on to Winnipeg with its greater array of choice than the fourth order. In both systems, however, residents of third order centres are displaying a tendency to use the highest order of service centre in the systems. Again, it may be noted that while these three settlements are similar in terms of service status they differ demographically and in respect of their economic bases: Red Lake is a mining town and Sioux Lookout and Rainy River are railway towns, while the populations of the Red Lake and Sioux Lookout are each almost twice the Rainy River population.

Five second order centres are recognised, with twelve functional types characterising them and differentiating them from centres of the first order. These range from filling station and food store to barber shop and bank. The economic bases of the centres differ. Balmertown is a mining town, Keewatin a flour milling town and Vermilion Bay, Sioux Narrows and Emo are primarily concerned with service provision.

There are twenty-three first order centres and ten of these occur in the Rainy River area of dispersed population and five in the Dryden area of dispersed population. Of the others, Nestor Falls is a tourist service centre and the remainder are primarily concerned with woods operations or mining.

Thus two systems of service centres exist in the study area and similarities in service status co-exist with dissimilarities in population size and economic base. There is no regular numerical progression in order membership.

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CHAPTER 4

CONSUMER BEHAVIOUR: DISPERSED POPULATION

There are three main areas of dispersed population in Northwestern Ontario: in the vicinity of Dryden, between Fort Frances and the town of Rainy River in the District of Rainy River, and at the Lakehead.

The sample survey yielded nineteen responses in the Dryden area, 102 responses in the Rainy River area and 192 responses in the Lakehead area. Desire line maps were prepared from the Dryden area data but the number of respondents was too low for any real patterns to emerge. Moreover, the total number of responses was too low to allow strata of any reasonable size to be derived. For these two reasons, analysis of returns for the rural dispersed population is confined to the two areas of Rainy River and the Lakehead. The order of presentation of the results follows the order of treatment of the data: the results for Rainy River, and then those for the Lakehead.

For each of these two areas the basic data have been treated in three different ways for each item: tables have been prepared detailing which centres are visited, desire line maps based on these data have been prepared for each item and, on the bases of these two types of information, the travel distance and travel time of each consumer for each item has been calculated. These three forms of the results are presented for each item in respect of the Rainy River area and, whereas distance and settlement choice data are presented

for each item in respect of the Lakehead area, a reduced array of desire line maps is presented. A brief description of each area precedes presentation of results.

RAINY RIVER

Description of the Area

The Rainy River dispersed population occupies an area of sedimentary lowland abutting on the Canadian Shield to the north-east, flanked by the Rainy Lake to the east and the Lake of the Woods to northwest and separated from the State of Minnesota (United States) by the westwards-flowing Rainy River (Figures 1.1 and 4.1). The area was the site of fur trade posts, the Dawson Route to the Red River country traversed it (Chapter 1) and the area was opened up for agricultural settlement in the eighteen-seventies. Despite the early start, few townships have been completely settled, few rural municipalities have been incorporated, and the area is now losing population. The pattern of settlement is most easily gauged from the road network (Figure 4.1). Highway 11 is paved and connects Fort Frances and Rainy River over a distance of fifty-four miles. To the east Highway 11 connects Fort Frances to Atikokan and the Lakehead, while to the west Highway 11 connects Rainy River with Winnipeg through the United States, by crossing the Rainy River to Baudette (Minnesota) and skirting the southern shore of the Lake of the Woods to Manitoba. An alternative route to Winnipeg is provided by the paved Highway 71 which travels northwards through Nestor Falls and Sioux Narrows to link up with Highway 17. The remainder of the roads in the area are of gravel and the network of

gravel roads is best developed in the south of the area, in the vicinity of Highway 11.

Four levels of service centre have developed in the area: the fourth order centre of Fort Frances in the extreme east; the third order centre of Rainy River in the extreme west; the second order centre of Emo, on Highway 11; and five first order centres on Highway 11 (La Vallée, Devlin, Barwick, Stratton, and Pinewood) and five first order centres in the northern section of the area (Black Hawk, Arbor Vitae, Gameland, Bergland, and Morson). Additional service points (single establishments) have developed at Burriss, North Branch and Sleeman (cf. Figures 4.1 and 3.11).

In subsequent sections of this chapter it is shown how this area falls under the influence of an increasing number of service centres as mean travel distances decline and service provision becomes more dispersed.

Ordering the Items

The first problem encountered is the order in which to present the results for each item. There are a number of possibilities. The results may be presented following the item-sequence in the questionnaire but the sequence adopted there grouped the items to aid respondents during the interviews; they may be presented in haphazard or random sequence but either procedure may serve to obscure groupings or associations of items that exist in reality; or they may be presented in a sequence based upon differences in distances or times, and then in either ascending or descending order. Resolution of whether to utilise distance or time in this and subsequent analyses

was achieved by comparing the arrays of sample travel distances and sample travel times for each item by means of Pearson's Product Moment Coefficient of Correlation (Ferguson, 1959, pp. 86-93). Since the observed relationship between travel times and distances may appear only in the sample and may not exist in the complete population from which the sample was drawn, values of t were calculated for each sample correlation coefficient (r) and referred to Table B in Ferguson (1959, p. 308). The complete list of results is shown in Table 4.1. The relationships are strongly positive: only one result (medical specialist, last visit) falls below +0.9, with a value of +0.88; all of the others have at least a value of +0.9 and most of these are in the +0.97-+0.99 range. With such strong positive correlation between travel distances and travel times, it is reasonable to consider only travel distances in subsequent analyses.

As an experiment, the desire line maps of all most buy items and the last buy items for which most buy information was not collected were displayed on a wall and an attempt was made visually to rank them in terms of the mean distance involved. This procedure proved difficult on three grounds: the varying number of responses, the varying points of origin of the desire lines and the varying number of long-distance trips. The attempt was made, nevertheless, and the ranking of the goods based upon descending mean travel distances (estimated visually) is presented in Table 4.2.

In the process of estimating the ranking, which was undertaken prior to any calculations of aggregate and mean distances, it was particularly difficult to assess the influence of long-distance journeys (to centres such as Winnipeg), because the full lengths of

TABLE 4.1

RAINY RIVER: TRAVEL DISTANCE & TIME CORRELATIONS

Item (Most buy)	r	df	t
Men's work clothes	0.99	71	76.88 *
Women's shoes	0.99	63	61.98
Men's shoes	0.97	82	42.02
Teenage girls' clothes	0.99	18	52.08
Children's clothes	0.99	27	60.67
Men's clothes	0.99	71	112.80
Women's clothes	0.99	58	122.80
Drugs	0.98	96	50.34
Groceries	0.98	98	52.14
Meat	0.97	78	41.89
Doctor	0.98	98	51.52
Medical Specialist	0.97	43	27.94
Dentist	0.99	97	88.33
Lawyer	0.99	67	63.30
Car Insurance	0.99	89	69.96
Optometrist	0.99	79	79.27
Bank	0.97	95	47.59
Hospital	0.98	96	64.55

TABLE 4.1/cont.

Item (Last buy)	r	df	t
Men's work clothes	0.99	77	80.17
Women's shoes	0.99	62	102.80
Men's shoes	0.99	84	68.74
Teenage girls' clothes	0.99	22	43.00
Children's clothes	0.98	38	32.34
Men's clothes	0.99	69	83.06
Women's clothes	0.99	65	155.
Drugs	0.97	95	47.61
Groceries	0.97	99	46.35
Meat	0.97	83	42.29
Television	0.99	76	73.96
Fridge	0.99	90	124.33
Furniture	0.99	76	102.76
Watch	0.99	75	79.12
Jewellery	0.99	56	105.19
Car	0.99	90	127.45
Farm Machinery	0.99	67	74.15
Doctor	0.99	98	87.70
Medical Specialist	0.88	44	12.76
Dentist	0.99	96	90.42
Lawyer	0.99	65	64.85
Car Insurance	0.97	88	43.27
Optometrist	0.99	78	110.
Bank	0.99	96	71.23
Hospital	0.99	93	157.40

* t-value required for significance at 0.05 = 2

the desire lines were not portrayed. In general terms, the ranking procedure places highest those items involving a large proportion of respondents in long-distance travel out of the region; it places next those items involving a concentration from within the region on

Fort Frances; next those items involving use of the three main service centres within the region -- Fort Frances, Emo and Rainy River; and it places last those items involving use of a more diffuse pattern of supply within the region. The process is crude and the necessity to group items in tied ranks (Table 4.2) reflects this. Most difficulty was experienced with teenage girls' clothes and children's clothes, for which travel was comparatively light.

TABLE 4.2

RAINY RIVER: VISUAL RANKING OF ITEMS

Rank	Item
1	Medical specialist
2	Car
3.5	Optometrist
3.5	Lawyer
6	Watch
6	Jewellery
6	Furniture
8.5	Women's coat
8.5	Men's coat
10	Dentist
11	Women's shoes
12	Men's work clothes
13	Men's shoes
16	Car Insurance
16	Drugs
16	Hospital
16	Bank
16	Family doctor
20	Refrigerator
20	Farm machinery
20	Television
22.5	Teenage girls' clothes
22.5	Children's clothes
24.5	Groceries
24.5	Meat

A more precise method of ranking involves the use of the measured sample mean travel distances, and the items have been ranked on the basis of these in Table 4.3. (It should be emphasised that

the number of respondents reporting travel for an item rather than the total number of respondents reporting consumption of an item is used as the denominator of the aggregate distance: that is, n excludes those obtaining an item by catalogue or post.)

TABLE 4.3

RAINY RIVER: SAMPLE MEANS OF ITEMS (in miles)

Most Buy Rank	$\bar{x}$	Item	Last Buy $\bar{x}$	Last Buy Rank	(most buy $\bar{x}$)
1	182.0	Medical specialist	183.6	1	
2	62.3 *	Car		2	(62.3)
3	39.5	Women's coat	56.9	3	
4	35.8	Watch		6	(35.8)
5	34.4	Furniture		8	(34.4)
6	34.2	Jewellery		9	(34.2)
7	32.6	Optometrist	35.6	7	
8	31.8	Men's coat	41.6	4	
9	27.4	Lawyer	27.5	13	
10	27.3	Dentist	31.6	11	
11	24.7	Refrigerator		14	(24.7)
12	24.1	Teenage girls' clothes	34.1	10	
13	21.5	Farm machinery		16	(21.5)
14	20.9	Men's work clothes	19.8	17.5	
15	19.1	Children's clothes	16.5	20	
16	18.9	Women's shoes	28.3	12	
17	17.7	Hospital	38.1	5	
18	16.6	Bank	19.8	17.5	
19	15.9	Television		21	(15.9)
20	15.9	Car insurance	14.0	23	
21	15.7	Drugs	15.6	22	
22	15.7	Men's shoes	24.6	15	
23	15.4	Doctor	19.3	19	
24	12.4	Groceries	10.3	25	
25	11.5	Meat	12.4	24	

* Last buy means are considered as most buy means.

Considering only most buy data, the sample mean for medical specialist is almost three times the next-ranked sample mean (car). Therefore it seems safe to rank this first. Apart from the medical specialist and car sample means, most other sample means are very

close to one another: for example, the sample mean for furniture is 34.4 miles, and that for jewellery is 34.2 miles. Also shown in Table 4.3 are the sample means calculated from data relevant to last purchase. Some disturbing relationships emerge. Whereas the sample car mean (most buy) is 62.3 miles and the sample women's coat mean (most buy) is 39.5 miles -- apparently well apart, the sample women's coat mean (last buy) is 56.9 miles, less than six miles below the sample car mean (most trips). Moreover, there is a difference of some seventeen miles between the sample means for women's coat based on most buy and last buy data (39.5 miles/56.9 miles).

Each sample mean, however, bears a relationship to the mean of the complete body of data from which the sample data have been drawn and this relationship can be stated in accordance with specified limits. The statistic employed is the standard error of the sample mean. Both columns of sample means in Table 4.3 are reproduced in Table 4.4, and the value of the standard error of the sample mean and the value of the standard error of the sample mean (S.E. $\bar{x}$) at the 0.05 confidence level are also shown. From the data presented in this table, the value of the true mean ($\overline{X}$)may be predicted within a specified range of the sample mean, for a given level of confidence (here 0.05):

$$\overline{X} = \bar{x} \pm 1.96 \text{ S.E.}\bar{x}.$$

In the case of medical specialist (most buy), then,

$$\overline{X} = 182.0 \pm 1.96 \times 10.2$$

$$= 182.0 \pm 20.0$$

The true mean distance, therefore, lies between 162.0 miles and 202.0 miles at the 0.05 level. It is important for

TABLE 4.4

RAINY RIVER: SAMPLE MEANS AND STANDARD ERRORS *

Most Buy			Item	Last Buy		
$\bar{x}$	S.E.$\bar{x}$	S.E.$\bar{x}$.05		$\bar{x}$	S.E.$\bar{x}$	S.E.$\bar{x}$.05
182.0	10.2	20.0	Medical Specialist	183.6	9.4	18.4
62.3	7.7	15.1	Car			
39.5	7.2	14.1	Women's coat	56.9	8.8	17.2
35.8	6.2	12.2	Watch			
34.4	5.3	10.4	Furniture			
34.2	6.3	12.3	Jewellery			
32.6	3.2	6.3	Optometrist	35.6	4.7	9.2
31.8	5.6	11.0	Men's coat	41.6	7.2	14.1
27.4	2.3	4.5	Lawyer	27.5	2.3	4.5
27.3	3.3	6.5	Dentist	31.6	4.5	8.8
24.7	4.4	8.6	Fridge			
24.1	9.0	17.6	Teenage girls' clothes	34.1	9.0	17.6
21.5	3.4	6.7	Farm machinery			
20.9	3.6	7.1	Men's work clothes	19.8	3.4	6.7
19.1	6.1	12.0	Children's clothes	16.5	2.2	4.3
18.9	3.2	6.3	Women's shoes	28.3	5.7	11.2
17.7	2.1	4.1	Hospital	38.1	6.4	12.5
16.6	1.2	2.4	Bank	19.8	2.5	4.9
15.9	3.0	5.9	Television			
15.9	2.4	4.7	Car insurance	14.0	1.1	2.2
15.7	1.1	2.2	Drugs	15.6	1.1	2.2
15.7	1.6	3.1	Men's shoes	24.6	4.1	8.0
15.4	1.2	2.4	Doctor	19.3	2.9	5.7
12.4	1.2	2.4	Groceries	10.3	1.0	2.0
11.5	1.2	2.4	Meat	12.4	1.3	2.5

* in miles

ranking purposes that the lower limit of this range (162.0 miles) lies above the upper limit (77.4) of the range (47.2 - 77.4) of the item ranked second (car). The situation is more confused in the lower reaches of the sample means, where there is considerable overlap of the ranges. This situation is portrayed in Figure 4.2 (The first item, medical specialist, is omitted from the figure because of the difficulty of adequately accommodating it within the scale necessary to show the variation in the fifteen to forty-five mile range.) The full thrust of the relationships shown in Figure 4.1 may be discovered by examining the mean distance of twenty-six miles: all of the items numbered from 3 (women's coat) to 15 (children's clothes) could conceivably possess this mean. The relationships portrayed in Figure 4.2 also point up the significance of the varying number of responses. In the lower reaches of the total range, the limits within which the true mean for teenage girls' clothes and children's clothes might be expected to fall are comparatively wide. There are limits of comparable width in the upper reaches of the total range (car and watch, for example) but variability of the data input, rather than low number of inputs, may be the cause.

Comparison of most trip and last trip data presented in Table 4.4 raises a number of apparent anomalies. Whereas in some cases there is a close correspondence between both types of sample mean and standard errors of mean (for example lawyer: most buy $\bar{x}$ = 27.4 m., s.e. $\bar{x}$ = 2.3 m.; last buy $\bar{x}$ = 27.5, s.e. $\bar{x}$ = 2.3.), there are cases where it seems possible that the limits of the true mean for most buy will not overlap the limits of the true mean for last buy, at the desired level of confidence. To provide a basis of

accurate comparison, Figure 4.3 was prepared, again omitting medical specialist to avoid scale distortion. (Also omitted are those items for which only one type of data was collected: that is, last buy data.)

Of the seventeen pairs of limits of true mean shown in Figure 4.3, only one pair (hospital -- 17) do not overlap. Except in this one case,then, given the possibility of most buy and last buy means occurring anywhere within their respective limits, use of either set of data is possible; nor does the procedure of considering only last buy data for seven items and treating them along with most trip data appear unreliable.

The test for standard error of the difference between two means (Gregory, 1963, pp.121-126), would provide a more precise measure of whether most buy and last buy means for the same item differ, and of whether any two most buy means for different items differ. This test, however, involves the use of the best estimate of the standard deviation ($\hat{\sigma}$), which in turn is derived from the sample standard deviation (s). The standard deviation is a powerful descriptive statistic when the individual values are normally or nearly normally distributed about the mean. Visual inspection of the means and standard deviations of the Rainy River distances suggested that the data are not normally distributed and are in fact skew. For example, the sample mean ($\bar{x}$) for men's work clothes is 20.9 miles and the sample standard deviation is 30.9 miles. This suggests that a large number of short distances below the sample mean are balanced by a smaller number of longer distances above the mean: that the distribution is positively skew.

Whether or not a particular distribution may be considered as normal can be calculated: the procedure involves assembling the observed individual values into classes, calculating the theoretically normal frequencies for the class intervals and testing the goodness of fit between the theoretical and observed distributions (Ferguson, 1959, pp. 162-165).

It was decided to test the distribution of distances for groceries (most trips) to determine whether or not that distribution departed too far from the normal distribution for the sample standard deviation to be of use as an effective statistic. The values for the distance travelled to purchase groceries may be summarised as follows:

Range = 0.4 miles - 53.2 miles

Sample Mean ($\bar{x}$) = 12.39 miles

Sample Standard Deviation (s) = 11.54 miles

No. of values (n) = 100

The first task is to convert the one hundred values to a frequency distribution, a process that involves the determination of an appropriate number of classes. Sturges rule may be used as a guide (Chou, 1969, p. 29):

$$K = 1 + 3.3 \log n$$

where

K = the approximate number of classes

n = the total number of observations in the sample

log = the ordinary logarithm to the base 10.

In the case of the grocery distribution:

$$K = 1 + 3.3 \log 100 = 1 + 3.3 (2.0000) = 7.6$$

Preliminary scrutiny of the list of individual values comprising the grocery distribution suggested that most of the values are clustered in the lower reaches of the range. Accordingly, it was decided to utilise eight classes of five miles each, starting with the value 0 miles and ending with the value 40 miles. After allocation of values to classes it was discovered that three values, each in excess of 40 miles, were unassigned; therefore, the last class was broadened to include these. A histogram, which comprises Figure 4.4, gives the shape of the observed distribution of sample values. Before applying the test, the sparsely occupied classes in the upper tail of the distribution were combined as follows: classes 6 and 7, to yield a class of eight members; classes 4 and 5, to yield a class of sixteen members. This adjusted observed frequency distribution is shown in the first column of Table 4.5. Application of the appropriate test (Ferguson, 1959, p. 163) yields the expected frequency distribution shown in the second columnof Table 4.5

TABLE 4.5

RAINY RIVER: GROCERY DISTANCES -- OBSERVED AND EXPECTED FREQUENCIES

Class Interval	Ob.	Ex.
35 - 53.2	7	3
25 - 34	8	12
15 - 24	16	27
10 - 14	20	17
5 - 9	21	16
0 - 4	28	25
	100	100

The Chi-square (X^2) test allows comparison of the observed and expected frequencies and the application of this test to the two frequency distributions shown in Table 4.5 yields the value $X^2 = 13.59$, and there are three degrees of freedom (df).

The null hypothesis (H_0) in this case states that the observed sample population has been drawn randomly from a normally distributed population. The value of X^2 at the 0.05 level, where df = 3, is 7.82 and to accept H_0 the calculated value of X^2 must fall below this critical value. It does not, therefore H_0 is rejected and the alternative of the null hypothesis (H_1) is accepted: namely, that the sample population has not been drawn randomly from a normally distributed population.

The same test was applied to three other sets of sample values, those for family doctor, medical specialist and men's work clothes. In each case it was found that the sample population had not been drawn randomly from a normally distributed population.

In a recent and similar study Golledge *et al.* (1966) obtained two types of distance values for thirty-three commodities. They prepared a cumulative frequency graph for both types of distance data in respect of groceries which, they claimed, indicated an "almost complete absence of extreme values which might lend unreliability to the means and standard deviations used" in their study (p. 262). They gave no indication of having applied a test for normalcy; and comparison of their values (Table 4.6) and those used in this study (Appendix 12) suggests that at least some of the means and standard deviations used by them might have introduced an element of unreliability.

TABLE 4.6

SUMMARY STATISTICS USED IN IOWA STUDY

	Commodity	No. of obser.	Distance to max. purchase town (Miles)		Distance to near. purchase town (Miles)	
			Mean	σ	Mean	σ
1.	Food and Drink away	432	10.7	12.1	6.9	5.8
2.	Personal care	374	10.7	16.7	8.4	11.8
3.	Male clothing	459	15.6	17.0	8.2	6.0
4.	Female clothing	433	30.3	57.7	14.1	33.9
5.	Boys' clothing	255	15.6	11.4	9.6	6.4
6.	Girls' clothing	226	29.3	53.4	13.4	27.3
7.	Clothing as gifts	386	17.7	19.1	12.0	8.3
8.	Major appliances	116	14.5	24.5	13.8	24.3
9.	Minor appliances	123	26.0	44.1	25.2	44.0
10.	Furniture	171	18.7	17.6	17.6	17.1
11.	Textiles	287	20.5	24.8	19.6	24.5
12.	Glassware--silver	283	14.6	31.0	13.8	30.9
13.	Fuel--house	452	8.0	7.0	6.9	6.3
14.	Repairs--house	256	12.2	18.3	9.0	10.2
15.	Physician	378	13.6	23.5	10.4	11.7
16.	Dentist	318	11.1	7.6	10.9	7.2
17.	Medicines--prescribed	248	11.5	19.3	10.8	18.9
18.	Medicines--not prescribed	339	9.2	7.6	8.6	7.4
19.	Movies	254	16.7	31.5	13.9	23.0
20.	Sporting goods	231	14.1	19.5	10.2	14.8
21.	Hobby equipment	287	13.3	23.0	11.4	21.3
22.	Toys	210	15.0	11.5	12.9	9.6
23.	Pets and pet care	321	13.4	8.6	12.9	8.3
24.	Running cost of car	430	7.2	7.4	5.4	3.4
25.	Church	400	5.4	4.1	5.2	3.8
26.	Gifts--organizational	390	9.3	15.3	8.5	13.7
27.	Beauty and barber	432	7.4	9.5	6.1	4.4
28.	Dry cleaning	424	10.5	9.5	10.3	9.5
29.	Shoe repair	318	9.5	6.0	9.3	5.6
30.	Food locker	299	9.9	25.8	9.8	25.7
31.	Repairs--Television and appliances	333	7.9	5.9	7.6	5.6
32.	Car purchases	78	19.7	23.9	18.8	23.0
33.	Food--groceries	459	7.8	5.3	5.2	3.6

Source: Golledge *et al.* (1966, p.263)

In any event, it is apparent that parametric tests (those involving assumptions about the mornalcy of the parent distributions) are unsuitable for application to the Rainy River sample populations of distances. Non-parametric tests, however, make relatively few assumptions about the parent population and appear appropriate in this context.

The rank-test for two independent samples (Ferguson, 1959, pp. 268-269) is used here to compare the most buy and last buy means for the same item and to compare the most buy means of two different items.

Briefly, the method tests the null hypothesis (H_0) that two sample populations have been derived from identical continuous parent populations, which by definition would have identical means, against either of two alternative hypotheses: either that the two sample populations differ (and their means would therefore differ), a non-directional hypothesis; or that one of the sample populations is derived from a parent population stochastically larger than the other, in which case the mean of the larger parent population would be greater than the mean of the smaller parent population, a directional hypothesis (Ferguson, 1969, pp. 268-269; Siegel, 1956, pp. 116-126; Miller and Freund, 1965, pp. 214-216).

Where the sample means of the same item are being compared, the point at issue is whether or not there is a difference. Accordingly the appropriate alternative to the null hypothesis of no difference ($H_0:\overline{X}_1 = \overline{X}_2$) is that there is a difference ($H_1:X_1 \neq X_2$).

Where the sample means of different items are being compared with a view to ordering the commodities, the appropriate alternative to the null hypothesis of no difference ($H_0:\overline{X}_1 = \overline{X}_2$)

is that the first population is stochastically larger than the second ($H_1 : \bar{X}_1 > \bar{X}_2$).

The exact form of the rank-test employed is determined by the size of the samples (Ferguson, 1959, p. 269; Siegel, pp. 117, 119 and 121). None of the samples examined here consists of less than twenty members, therefore the form of the rank-test outlined in Ferguson (1959, pp. 268-269) is employed. The procedure involves combining two independent samples and arranging the values in ascending rank-order. A rank of 1 is assigned to the lowest value, a rank of 2 to next lowest and so on. Although the ranking is performed without distinguishing between the two samples, the sample identity of the rank values is retained to allow the sum of the rank values for each sample to be obtained. It should be noted that where sample values are tied, each sample value is assigned the mean of the rank values which would have been assigned had no ties occurred.

The actual sum of the ranks for each sample may be compared with the sum of the ranks expected if the assumption is made that both samples are derived from identical continuous populations.

The expected value of the sum of the rank-values for the first sample -- $E(R_1)$ -- is yielded by the following expression:

$$E(R_1) = \frac{N(N_1 + N_2 + 1)}{2}$$

where N_1 is the number of observations in the first sample

N_2 is the number of observations in the second sample

$N = N_1 + N_2$.

The normal deviation (Z) of the actual sum of the ranks in the first sample (R_1) from the sum of the ranks expected on the

basis of the assumption of identical parent populations, is given by:

$$Z = \frac{R_1 - E(R_1)}{\sqrt{\frac{N_1 N_2 (N_1 + N_2 + 1)}{12}}}$$

If, however, there are numerous ties in rank values a correction has to be applied and the formula is transformed to

$$Z = \frac{R_1 - E(R_1)}{\sqrt{\left[\frac{N_1 N_2}{N(N-1)}\right]\left[\frac{N^3 - N}{12} - T\right]}}$$

where $N = N_1 + N_2$; and $T = (t^3 - t)/12$, where t is the number of values from both samples tied at a particular rank.

The ranking procedure is time-consuming and the distance values for most of the items were entered on punch cards for computer analysis. Cost and time constraints dictated that some items be omitted; accordingly, it was decided to enter the complete sets of distance values for the means of all items shown in the left-hand column of Table 4.3, since it was desired to order these items, and to enter only a restricted number of sets for the means of the items shown in the right hand column. The choice of what to include was made on a basis of wide discrepancies between most buy and last buy sample means, high standard errors of sample means, and low amounts of overlap between the confidence limits of most buy and last buy means. Thus sets of last buy distance values for the following items were also entered on punch cards: women's shoes, men's shoes, teenage girls' clothes, men's coat, women's coat, family doctor,

dentist, and hospital.

A computer programme was written to perform the tests but as a check on the reliability of both programme and punch carding two sets of sample distance values (groceries and meat) were examined with the aid of an electronic calculator. This examination provided values for each element in the formula, values not normally obtained in computer output, and these are presented here.

Pertinent data utilised in hypotheses formulation and in calculation are

	Groceries	Meat
No. of values in sample	$(N_1) = 100$	$(N_2) = 80$
Sample mean	$(\bar{x}_1) = 12.4$ miles	$\bar{x}_2 = 11.5$ miles
Sum of ranks	$(R_1) = 9{,}130.5$	R_2 = not calculated

Hypotheses

H_0: The distance values for the grocery sample and the meat sample are derived from identical parent populations and, therefore, there is no difference between the means.

H_1: The two sets of sample distance values are not derived from identical population means and, on the basis of the evidence of the sample means ($\bar{x}_1 = 12.4$ miles; $\bar{x}_2 = 11.5$ miles), the true mean of grocery distances ($\overline{X}_1$) is greater than the true mean of meat distances ($\overline{X}_2$).

Substituting these data in the formula:

$$Z = \frac{9{,}130.5 - 9{,}050}{\sqrt{\left[\frac{100 \times 80}{180\,(180-1)}\right]\left[\frac{180^3 - 180}{12} - 3{,}675\right]}}$$

$$= \frac{80.50}{\sqrt{0.24 \times 482{,}310}}$$

$$= 0.2326$$

(Computer output for this value is 0.23).

This value falls below the value of 1.56, the critical value established here for significance at the 0.05 level in a one-sided alternative (Siegel, 1956, Table A, Appendix, p.247). (The critical value of 1.96 for two-sided alternatives at the 0.05 level is recommended by Ferguson (p. 135) and this critical value is employed in this study; but Ferguson recommends use of 1.64 as the critical value, at the 0.05 level, for one-sided alternatives. Examination of Table A in Siegel (1956, p. 247) suggests that any value in the range 1.56 - 1.64 might be employed, and 1.56 is used here. The use of this slightly lower critical value means that rejection of the null hypothesis is slightly more frequent than if a critical value of 1.64 had been adopted.

The first set of tests performed examined the relationship, for selected items, between sample data for most buy and for last buy distances.

H_0: There is no difference between the means of the parent populations for most buy and last buy of the same item.

H_1: There is a difference.

H_1 is a two-sided alternative and therefore values of Z of 1.96 or greater are necessary to reject H_0 and to accept H_1. The values of Z obtained are given in Table 4.7.

TABLE 4.7

RAINY RIVER: COMPARISON OF MOST BUY AND LAST BUY MEANS

Item	Z-value	Critical Value (at 0.05 sig.)
Women's coat	1.10	1.96
Men's coat	0.64	1.96
Dentist	0.26	1.96
Teenage girls' clothes	1.27	1.96
Women's shoes	0.32	1.96
Hospital	1.53	1.96
Men's shoes	0.99	1.96
Doctor	0.38	1.96

No Z-value is as large as the critical value of 1.96 and, therefore, the null hypothesis of no differences between the pairs of means if accepted. Noticeably the difference suggested by the parametric tests in the two types of hospital data is not substantiated in this more appropriate non-parametric test. As the sample means of the items listed in Table 4.7 represent the most divergent relationships between most buy and last buy, it is argued that since no significant differences emerge here it is unlikely that significant differences exist between the pairs of means for the items not considered.

It may then be argued that it is reasonable to consider most buy and last buy data together, as is the case in the left-hand column of Table 4.3. The comparison suggests, also, that comparable data on distance are yielded by asking two different types of questions -- at least in the case of the Rainy River respondents.

The relationship amongst the true means of the populations represented by the sample means in Table 4.3 may be examined. This

examination consists of selecting the sample distance value of the highest ranked item and comparing it in turn with the sample distance values of every other item ranked below it in Table 4.3. Thus, the sample distance values of medical specialist are compared in turn with the sample distance values of car, then women's coat, and so on to meat. Then, the item ranked second in Table 4.3 (car) is compared in turn with all items ranked below it. It follows that the number of tests performed decreases until, for example, doctor distance values are compared first with grocery distance values and then with meat distance values; and then grocery values are compared only with meat values.

For each performance of the test the following hypotheses are formulated:

H_0: there are no differences between the true means of the two items.

H_1: the mean of the parent population from which the sample population with the higher of the two sample means is drawn is larger than the true mean of the parent population from which the sample population with the lower of the two sample means is drawn.

For example $\bar{x}_1$ medical specialist = 182.0 miles and $\bar{x}_2$ car = 62.3 miles; H_0:$\bar{X}_1$ medical specialist = $\bar{X}_2$ car, and H_1:$\bar{X}_1$ medical specialist $>$ $\bar{X}_2$ car. The Z-value is 6.95; therefore, with a critical value of 1.56 at the 0.05 level, H_0 is rejected and H_1 is accepted. Although one sample mean may be higher than another sample mean, it is possible for the relative positions of the true means to be reversed. For example, $\bar{x}_1$ furniture = 34.4 miles and $\bar{x}_2$ optometrist = 32.6 miles; H_0:$\bar{X}_1$ furniture = $\bar{X}_2$ optometrist,

$H_1: \bar{X}_1 > \bar{X}_2$. The Z-value is -1.76; therefore H_0 is rejected, but H_1 cannot be accepted, because the negative value indicates the inverse of H_1 as originally formulated, that $\bar{X}_1 < \bar{X}_2$. The difference has turned out to be significant in the direction opposite to that indicated by the relative sizes of the sample means. Comparison of the range of possible values of $\bar{X}_1$ and $\bar{X}_2$ in Figure 4.2 (vertical lines numbered 5 and 7) indicates that it is entirely possible for $\bar{X}_1 < \bar{X}_2$. The result in this particular case demonstrates that the sample means may be unreliable indicators of the relative sizes of true means. Therefore an alternative method for ranking items has to be devised.

A matrix of 625 cells was constructed. On both axes the twenty-five items were listed in the descending order indicated by the sample means. The 300 appropriate Z-values were entered into the cells above the diagonal line formed by the co-ordinates of the same item, and the result is shown in Table 4.8. The profusion of values is confusing and no clear patterns emerge; therefore, all Z-values between -1.55 and +1.55, the critical region for acceptance of H_0, have been designated 0, and all values outwith this critical region, either of -1.56 or lower, or of +1.56 or higher, have been designated 1. In cases of a Z-value of between -1.55 and +1.55 no indication of the negative value is given in the 0 designation, for there is no significant statistical difference between true means. In case of a Z-value of -1.56 or lower the 1 designation is marked (*) to indicate the significant negative value. The result of this dichotomous scoring process is summarised in Table 4.9, which is interpreted as follows: the medical specialist-car cell is occupied by a 1, therefore $\bar{X}$ medical specialist $>$ $\bar{X}$ car, and $\bar{X}$

TABLE 4.8

RAINY RIVER: MATRIX OF Z-VALUES

	MSp	Car	WC	Wa	Fur	Jew	Opt	MC	Law	Dent	Ref	TGC	FM	MWC	CC	WS	Hos	Bank	TV	CI	Dru	MS	FD	Groc	Meat
MSp	--	6.95	6.84	7.60	7.61	7.01	7.51	7.50	7.58	8.04	8.20	5.71	7.97	8.01	6.55	7.87	8.62	8.55	8.41	8.52	8.65	8.47	8.70	8.90	8.63
Car		--	0.95	2.35	1.32	1.39	0.31	2.12	0.98	1.72	3.65	2.22	3.20	3.39	2.95	3.36	3.95	3.80	4.91	4.50	4.16	4.31	4.29	5.94	5.80
WC			--	1.38	0.08	0.25	-1.43	1.12	-0.48	0.37	2.61	2.01	2.21	2.45	2.69	2.51	2.94	2.69	4.13	3.72	3.12	3.33	3.31	4.97	5.11
Wa				--	-1.35	-1.06	-2.75	-0.30	-1.88	-1.20	1.09	0.79	0.62	0.97	1.30	0.97	1.26	1.09	2.74	2.08	1.47	1.80	1.63	3.50	3.61
Fur					--	0.16	-1.76	1.16	-0.62	0.35	2.87	2.14	2.32	2.68	2.87	2.78	3.23	2.98	4.54	4.17	3.46	3.67	3.69	5.41	5.58
Jew						--	-1.67	0.86	-0.77	0.08	2.35	1.77	1.90	2.18	2.43	2.20	2.59	2.38	3.82	3.36	2.76	2.99	2.94	4.66	4.78
Opt							--	2.73	1.07	2.39	4.52	3.02	4.03	4.40	4.04	4.46	5.08	4.80	6.04	5.90	5.37	5.42	5.54	6.95	6.96
MC								--	-1.74	-1.00	1.50	1.22	1.04	1.31	1.76	1.37	1.72	1.49	3.14	2.57	1.90	2.19	2.10	4.06	4.23
Law									--	1.11	3.42	2.49	3.03	3.32	3.39	3.36	3.90	3.64	5.07	4.77	4.15	4.28	4.34	5.96	6.07
Dent										--	2.88	2.19	2.29	2.68	2.95	2.76	3.32	2.96	4.74	4.39	3.54	3.77	3.81	5.70	5.87
Ref											--	0.28	-0.50	-0.21	0.64	-0.13	0.12	-0.13	1.80	1.02	0.29	0.71	0.52	2.81	3.01
TGC												--	-0.55	-0.47	0.22	-0.51	-0.28	-0.38	0.89	0.27	-0.18	0.09	-0.04	1.67	1.83
FM													--	0.27	0.95	0.29	0.63	0.32	2.23	1.49	0.79	1.13	1.00	3.18	3.35
MWC														--	0.88	0.08	0.34	0.07	2.01	1.31	0.50	0.90	0.73	2.93	3.18
CC															--	-0.83	-0.66	-0.85	0.82	0.07	-0.54	-0.20	-0.39	1.60	1.80
WS																--	0.26	-0.00	1.91	1.24	0.42	0.82	0.65	2.87	3.14
Hos																	--	-0.28	1.88	1.05	0.16	0.62	0.41	2.94	3.20
Bank																		--	2.12	1.34	0.46	0.89	0.69	3.11	3.35
TV																			--	-0.92	-1.74	-1.21	-1.55	0.88	1.14
CI																				--	-0.94	-0.41	-0.68	2.04	2.34
Dru.																					--	0.45	0.26	2.74	3.04
MS																						--	-0.23	2.16	2.43
FD																							--	2.60	2.89
Groc																								--	0.23
Meat																									--

TABLE 4.9

RAINY RIVER: CONVERSION OF Z-VALUES

	MSp	Car	WC	Wa	Fur	Jew	Opt	MC	Law	Dent	Ref	TGC	FM	MWC	CC	WS	Hos	Bank	TV	CI	Dru	MS	FD	Groc	Meat
MSp	--	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Car		--	0	1	0	0	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
WC			--	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Wa				--	0	0	1*	0	1*	0	0	0	0	0	0	0	0	0	1	1	0	1	1	1	1
Fur					--	0	1*	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Jew						--	1*	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Opt							--	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
MC								--	1*	0	0	0	0	0	1	0	1	0	1	1	1	1	1	1	1
Law									--	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Dent										--	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Ref											--	0	0	0	0	0	0	0	1	0	0	0	0	1	1
TGC												--	0	0	0	0	0	0	0	0	0	0	0	1	1
FM													--	0	0	0	0	0	1	0	0	0	0	1	1
MWC														--	0	0	0	0	1	0	0	0	0	1	1
CC															--	0	0	0	0	0	0	0	0	1	1
WS																--	0	0	1	0	0	0	0	1	1
Hos																	--	0	1	0	0	0	0	1	1
Bank																		--	1	0	0	0	0	1	1
TV																			--	0	1*	0	0	0	0
CI																				--	0	0	0	1	1
Dru																					--	0	0	1	1
MS																						--	0	1	1
FD																							--	1	1
Groc																								--	0
Meat																									--

*Significant negative values.

medical specialist is greater than all $\overline{X}$'s; the car-women's coat cell is occupied by a 0, therefore there is no difference between $\overline{X}$ car and $\overline{X}$ women's coat; but the car-watch cell is occupied by a 1, therefore $\overline{X}$ car $>$ $\overline{X}$ watch.

The method of item-ranking adopted involves placing items on the basis of the number of other $\overline{X}'$s they exceed; the greater this number is, the higher than rank. Medical specialist $\overline{X}$ is therefore ranked first, as it is greater than all other twenty-four means. The optician $\overline{X}$ is ranked second as it is no different from three other $\overline{X}'$s (those of car, lawyer, and women's coat), but it is greater than twenty others. Visual inspection of Table 4.9 suggests that watch $\overline{X}$ has been wrongly ranked on the basis of the sample mean. The rank ordering of the items can be rearranged by a trial and error process, a process in which the statistically significant negative values are suggestive of the ordering, and the result of this rearrangement is shown in Table 4.10. The items are effectively ranked on basis of the number of the true means of other items that their own true means exceed.

Although this process aids effective ranking, it does not necessarily incorporate a guide to a desirable second step: namely, the subdivision of the whole array of items into classes, with each class possessing greater similarity amongst its means than with the means of items in other classes. Golledge *et al.*(1966) developed a sophisticated method of grouping items on the basis of distance travelled, but the method they utilised partly depended on parametric tests, already deemed inappropriate for application to the Rainy River distance data.

The relationships portrayed in Figure 4.2 and in Table 4.3

TABLE 4.10

RAINY RIVER: ADJUSTED RANKING OF ITEMS

		1 MSp	2 Opt	3 Car	4 Law	5 WC	6 Fur	7 Jew	8 Dent	9 MC	10 Wa	11 Ref	12 FM	13 MWC	14 WS	15 Bank	16 TGC	17 Dru	18 CC	19 Hos	20 CI	21 MS	22 FD	23 TV	24 Groc	25 Meat
1	MSp	--	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2	Opt		--	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
3	Car			--	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
4	Law				—	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
5	WC					--	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
6	Fur						--	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
7	Jew							—	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
8	Dent								--	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
9	MC									--	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1
10	Wa										--	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
11	Ref											--	0	0	0	0	0	0	0	0	0	0	0	1	1	1
12	FM												--	0	0	0	0	0	0	0	0	0	0	1	1	1
13	MWC													--	0	0	0	0	0	0	0	0	0	1	1	1
14	WS														--	0	0	0	0	0	0	0	0	1	1	1
15	Bank															--	0	0	0	0	0	0	0	1	1	1
16	TGC																--	0	0	0	0	0	0	0	1	1
17	Dru																	--	0	0	0	0	0	1	1	1
18	CC																		--	0	0	0	0	1	1	1
19	Hos																			--		0	0	1	1	1
20	CI																				--	0	0	0	1	1
21	MS																					--	0	0	1	1
22	FD																						--	0	1	1
23	TV																							--	0	0
24	Groc																								--	0
25	Meat																									--

seem to indicate only two groups on a basis of distance difference: medical specialist constituting one group; and the other twenty-four items making up the second group, for the mean distance of every item is no different from the mean distance of at least one other item.

Other relationships, however, are demonstrated in Table 4.10. There is a suggestion of a pattern based upon the similar numbers of items from which certain items differ, on a distance basis: thus the items numbered 5-8 may be considered a group, each having a true mean that exceeds the true means of the same other fifteen items; the items numbered 11-19 may be considered a group, if the anomalous 0 in the teenage girls' clothes - television cell is discounted,[1] each of these items having a true mean exceeding the true mean of the same three other items; and the items 23-25 may be considered a group, exceeding no other items and possessing no differences among their own true means.

The reordering process should now have completely excised all statistically significant negative Z-values, that is Z-values of -1.56 and lower. To ascertain whether or not this is the case, the tests were reperformed, pairing the goods in descending order as

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[1] The anomalous value (specified by 23,17) cannot be rearranged to advantage. Teenage girls' clothes could be placed on the vertical axis to occupy a position between items 19 and 20, but the same lateral repositioning would introduce an anomaly into the row of 1's associated with men's coat. A possible explanation of the anomaly is that the number of respondents to the question was low and the data may be less reliable than they would have been had there been a greater response. It is contended that this one anomaly does not destroy the validity of the technique: in a 256 cell matrix (part of a larger matrix), admittedly being used in a way slightly different from that used here, Golledge *et al.* (1966, p. 269) obtained two anomalous values.

they occur in Table 4.10; that is the true mean of medical specialist was compared with that of optometrist, then with that of car, and so on, terminating with that of meat; then, in turn, that of optometrist was compared with that of car, then lawyer, and so on. No statistically significant negative values occurred.

Whereas certain groups or classes of items have been tentatively recognised, these classes do not exhaust the whole array of items. Moreover, the basis of the groupings does not allow items 2-4 to be grouped, nor items 9 and 10; and, apart from the sharp break between medical specialist and all other items, the true mean distances appear to constitute a continuum.

All of this tends to suggest a gradual change in the spatial behaviour of consumers, item to item, rather than markedly different patterns being associated with different groups of items. Therefore, the spatial behaviour of consumers is examined in greater detail; in the first instance in respect of single items or groups of items as established by interpretation of Figure 4.2 and Table 4.10. Where behaviour within an item-grouping seems to vary greatly, an attempt is made firstly to consider sub-groups of items and, secondly, the items are considered singly. Explanations are suggested for variations in spatial behaviour.

Spatial Behaviour of Consumers

(1) Medical Specialist

The sample data for last trip and usual behaviour yield very close means for this item (183.6 miles and 182.0 miles, Table 4.3) but the two sets of data were not subjected to the

TABLE 4.11

RAINY RIVER: MEDICAL SPECIALIST SETTLEMENT CHOICE

	PA*	FW	FF	W	O	Total
Last buy	8 (17)	2 (4)	5 (11)	26 (57)	5 (11)	46 (100)
Most buy	9 (20)	2 (5)	6 (13)	27 (59)	1 (3)	45 (100)

*PA = Port Arthur; FW = Fort William; FF = Fort Frances; O = Other; W = Winnipeg

rank-sum test. It is possible to compare the two aspects of behaviour from another standpoint, from that of choice of centre. The actual numbers of respondents reporting on last trip to see a medical specialist and most trips to see a medical specialist are shown in Table 4.11 (with percentages in parentheses). Visual comparison of the two rows of figures does not suggest any major differences, but the chi-square test allows precise comparison at a stated level of comparison (Gregory, 1963, pp. 151-166; Ferguson, 1959, pp. 157-161).

The chi-square test basically consists of measuring the amount of difference between an observed frequency distribution and a theoretical frequency distribution: the observed frequencies are those of the sample data, set out in Table 4.11; the theoretical frequencies are those generated by the null hypothesis that there is no difference between the number of respondents choosing a particular centre on the last occasion on which they required the services of a medical specialist and those choosing a particular centre on a regular basis. This may be summarised as follows:

H_0: There is no difference between the two distributions shown in Table 4.11;

H_1: There is a difference between the two distributions shown in Table 4.11.

The statistic chi-square (X^2) is defined by

$$X^2 = \frac{(O - E)^2}{E}$$

where O = an observed frequency

E = an expected or theoretical frequency.

The expected frequencies are generated as follows:

Observed Frequencies

	PA	FW	FF	W	O	T
Last buy	8	2	5	26	5	46
Most buy	9	2	6	27	1	45
	17	4	11	53	6	91

$$\frac{46 \times 17}{91} + \frac{46 \times 4}{91} + \frac{46 \times 11}{91} + \frac{46 \times 53}{91} + \frac{46 \times 6}{91}$$

$$+ \frac{45 \times 17}{91} + \frac{45 \times 4}{91} + \frac{45 \times 11}{91} + \frac{45 \times 53}{91} + \frac{45 \times 6}{91}$$

Expected Frequencies

	PA	FW	FF	W	O
Last buy	8.58	2.02	5.56	26.79	3.03
Most buy	8.40	1.97	5.43	26.20	2.96

Application of the chi-square test is invalid, however, when the expected value of any cell falls below 2, with two or more degrees of freedom; and the expected value in the cell specified by most buy and Fort William equals 1.97. There are two possibilities; either the two sample frequency distributions may be compared visually

and conclusions about similarity or difference reached on this basis; or cells may be combined. Two additional points should be borne in mind: the combinations should have some logical basis and the degrees of freedom will be reduced.

In this case, it seems reasonable to combine into one cell, for both distributions, the Port Arthur and Fort William values under the heading of Lakehead, because travel to these two cities is in the same direction and involves almost equal distances. Thus adjusted the frequency distributions are:

	L	FF	W	O	T
Last buy	10	5	26	5	46
Most buy	11	6	27	1	45

and the expected frequencies are

	L	FF	W	O
Last buy	10.61	5.56	26.79	3.03
Most buy	10.37	5.43	26.20	2.96

$$X^2 = \frac{(10 - 10.61)^2}{10.61} + \frac{(5 - 5.56)^2}{5.56} + \frac{(26 - 26.79)^2}{26.74} + \frac{(5 - 3.03)^2}{3.03}$$

$$+ \frac{(11 - 10.37)^2}{10.37} \quad \frac{(6 - 5.43)^2}{5.43} \quad \frac{(27 - 26.20)^2}{26.20} \quad \frac{(1 - 2.96)^2}{2.96}$$

$$= 0.03 + 0.05 + 0.02 + 1.28$$

$$+ 0.03 + 0.05 + 0.02 + 1.29$$

$$= 2.77$$

There are four columns and two rows;

$$\text{therefore } df = (4 - 1)(2 - 1)$$

$$= 3 \times 1$$

$$= 3.$$

With df = 3, a X^2 value of 7.82 must be attained at the 0.05 level before H_0 is rejected. As X^2 = 2.77, H_0 is accepted: there is no statistically significant difference between the two frequency distributions.

The spatial pattern of consumer behaviour for medical specialist services (most buy) is shown by the desire line method (Figure 4.5). The overall pattern is one of travel out of the area, to either Winnipeg or the Lakehead. There is a suggestion of two service areas related to these two centres, with a zone of cleavage in the vicinity of Devlin and La Vallee. It is true that there is little to choose in this vicinity, on a distance basis, between travel to either centre: Winnipeg is approximately 205 miles distant from Devlin and the Lakehead is some 205 miles distant. However, any conscious choice by a prospective patient, on a distance basis, between a medical specialist in either Winnipeg or at the Lakehead, would be modified by that patient's family doctor's pattern of referral. If the family doctor is in the habit of referring the majority of his patients to a particular medical specialist, then longer journeys than are strictly necessary to obtain the service may result. Equally, the referring physician may take distance into account. Comparison of the patterns shown in Figure 4.5 (medical specialist travel) and Figure 4.24 (family doctor travel), suggests that Fort Frances-based physicians tend to refer their patients to the Lakehead for specialised medical attention and that the Emo physician and the Rainy River physicians tend to refer their patients to Winnipeg. These divergent tendencies, if accurately identified, would aid in explaining the indistinct zone of cleavage between the Winnipeg and Lakehead medical specialist service areas; for, in the

south, the western perimeter of the Emo physician's service area is approximately spatially coincident with the western perimeter of the Winnipeg medical specialist service area; and, in the north, the long journeys from the Arbor Vitae area to Fort Frances for the services of a family doctor have a parallel in the journeys from that area to the Lakehead for specialised medical services.

One apparent anomaly requires comment: the reported use of Fort Frances, by a small number of rural residents, for specialised medical services. It could be that these respondents misinterpreted the question and upgraded general medical treatment but no rural respondent reported receiving specialised medical treatment in either Emo or Rainy River, where general medical treatment is available. Comparison of Figures 4.5 and 4.24 shows that in most cases those reporting receiving specialised medical treatment in Fort Frances also receive general medical treatment there. It seems possible that for these respondents a variation in the level or nature of medical treatment at Fort Frances might have caused them to report this as specialised treatment as opposed to general treatment.

(2) Optometrist

TABLE 4.12

RAINY RIVER: OPTOMETRIST SETTLEMENT CHOICE

	FW	FF	Other	Total
Last buy	2	78	1	80
Most buy	1	79	1	81

Travel behaviour to secure the services of an optometrist is summarised in Table 4.12 and portrayed in Figure 4.6. Visual comparison of the two types of frequency distribution shown in Table 4.12 does not reveal enough divergence to warrant application of the X^2 test. Hence, subsequent analysis is restricted to the sample data describing regular behaviour.

Fort Frances is the sole centre within the area offering the service and the Fort Frances service area extends fan-shaped over the whole area. There are only two instances of trips to centres located outside of the area: one to Baudette and one to the Lakehead. The pattern shown is very similar to that later shown for travel for lawyer's services (Figure 4.8).

(3) Car

TABLE 4.13

RAINY RIVER: CAR SETTLEMENT CHOICE

	PA	FF	E*	RR	W&S	O	TOTAL
Last buy	4	46	16	2	16	8	92

* E = Emo; S = Steinbach.

Travel for car purchase is represented in Figure 4.7 and summarised in Table 4.13. There are four points of supply within the area: Fort Frances (with six car dealers), Emo (with two car dealers), Rainy River (with one car dealer) and Gameland (with no specialist car dealer). Slightly more than 72 per cent of the respondents reported patronising these places, whereas the remainder undertook longer journeys to purchase cars. The movement out of the area is quite significant *in toto* but most of it

is constituted by movement to Winnipeg and to Steinbach.

The overall pattern suggests intense competition. Fort Frances dominates in the area between itself and Devlin and loses a fraction of the potential trade there to the Lakehead. Fort Frances then meets competition from Emo; and from Winnipeg, which increasingly dominates westward, not to the total exclusion of Fort Frances but to the virtual exclusion of Rainy River.

The movement to Gameland requires comment: although there is no car dealer located there, a filling station is and it may be that either the proprietor arranges to supply cars to clients on an ad hoc basis or that he conducts low volume sales of second hand cars. (The questionnaire drew no distinction between new and used cars.)

Data pertaining to patronage motivation may be of some use in interpreting Figure 4.7. Respondents were asked to identify the single most important reason motivating their choice of place in which to buy a car. The distribution of responses is set out in Table 4.14.

TABLE 4.14

RAINY RIVER: CAR PURCHASE PATRONAGE MOTIVATION

Reason Given	No.	
Price of car	43	
No opinion	16	
Particular model available	10	
Dealer reputation	9	$X^2 = 89.66$
Selection	9	
After-sale service	4	
Other	1	
Total	92	

The chi-square test shows that differences in the distribution of responses are significant at the 0.05 level. Nearly fifty per cent of respondents identify price as their motivation in centre choice. Since certain economies of scale, resulting in lower sale prices, are possible at large dealerships in large centres, this will partially explain the dominance of Fort Frances. Noticeably, after-sale service is not a strong motivation -- probably because many service stations are recognised by major dealers to perform repairs under warranty and thus there is no need to purchase a car close to residence with a view to after-sale service at that place.

(4) Lawyer

TABLE 4.15

RAINY RIVER: LAWYER SETTLEMENT CHOICE

	FF	E	RR	TOTAL
Last buy	68	0	1	69
Most buy	67	1	1	69

Only one difference between the two types of sample data is revealed in Table 4.15 and without application of the chi-square test it may be asserted that there is no significant difference between the two distributions. Hence, only most buy behaviour is represented in Figure 4.8.

One discrepancy emerges that is difficult to explain. There is no lawyer permanently located in Emo; therefore, if the service had been obtained there on the last occasion but was usually obtained in Fort Frances (the reverse of the present situation),

it could be speculated the client had some business to transact which necessitated the lawyer's presence in Emo. This relationship -- most business in Emo, last business in Fort Frances -- would be plausibly explained as confusion in reporting, were it not for one rural resident reporting both last visit and regular visit to Rainy River to obtain a lawyer's services. No premises used by lawyers on a part-time basis were noted in the Emo and Rainy River surveys of establishments and it has not been possible to confirm or refute that a lawyer (or lawyers) practises in either Emo or Rainy River on a part-time basis. It may be that both respondents erred.

The overall pattern is easy to describe: Fort Frances dominates the whole area. Noticeably there is no travel to either the United States or to Winnipeg for the service. In the former case it may be asserted that the reason lies in the distinct difference between Canadian and American law; in the latter it may be suggested that the reason lies in the difference between Ontario and Manitoba laws. Confirmation of the latter may subsequently be sought when the patterns of movement of the nucleated population are examined.

(5-8) Women's Coat-Dentist

These items have been tentatively grouped on the basis of exceeding an identical array of items in respect of mean distance (Table 4.10) and, on the basis of the results of the rank-sum test (Table 4.10), it is asserted that there is no statistically significant difference amongst the parent populations of women's coat,

furniture, jewellery and dentist, from which the respective sample distances were drawn. It would be theoretically possible for this assertion to be valid but for statistically significant differences to exist amongst the distribution of settlement choices. If, however, there are no statistically significant differences amongst the distributions of settlement choices, there is no real need to present tables and figures for the three goods other than women's coat.

Of these four items, most buy and last buy data were collected for women's coat and dentist, whereas last buy data (which are treated as and compared with most buy data) were collected for furniture and jewellery. Accordingly, before inter-item comparison, comparison of data-pairs must be performed.

TABLE 4.16

RAINY RIVER: WOMEN'S COAT SETTLEMENT CHOICE

	L*	FF	E	RR	W	O	Total
Last buy	2	42	3	4	8	8	61
Most buy	0	47	3	3	5	2	60

*L - Lakehead

The difference between the sample means for the two types of information has been described but the rank-sum test demonstrates that there is no difference between the true means (Table 4.7). The variation in settlement choice between most buy and last buy is shown in Table 4.16.

As with women's coat, the rank-sum test for dentist (Table 4.7) fails to confirm the distance difference between last buy and most buy true means suggested by the sample means. It is necessary,

however, to test the two frequency distributions, set out in Table 4.17.

TABLE 4.17

RAINY RIVER: DENTIST SETTLEMENT CHOICE

	L	FF	E	RR	W	O	Total
Last buy	1	45	4	6	5	37	98
Most buy	0	54	5	2	4	34	99

The chi-square text, however, cannot be applied to the distributions in this form; some degree of concentration is required to increase the lowest expected value to at least a value of 2. A satisfactory arrangement is

FF	E & RR	W	O	Total
45	10	5	38	98
58	7	4	34	99

Comparison by the chi-square test yields a value $X^2 = 1.64$ (df = 3, at 0.05, critical value = 7.82); thus it may be asserted that the two distributions show no significant difference and the most trip distribution alone may be used.

Returning to the distributions for the four items (Table 4.18), the values involved suggest that a degree of concentration will be necessary before the chi-square test may be validly applied. A preliminary chi-square test confirmed this need and indicated those cells requiring combination with others.

TABLE 4.18

RAINY RIVER: FOUR ITEMS - SETTLEMENT CHOICES

	L	FF	E	RR	W	O	Total
Women's coat	0	47	3	3	5	2	60
Furniture	0	49	1	13	7	8	78
Jewellery	2	38	5	6	6	1	58
Dentist	0	54	5	2	4	34	99

The adjusted frequency distributions are

	FF	E & RR	W	O	Total
Women's coat	47 (78)	6 (10)	5 (9)	2 (3)	60 (100)
Furniture	49 (63)	14 (18)	7 (9)	8 (10)	78 (100)
Jewellery	38 (66)	11 (19)	6 (10)	3 (5)	58 (100)
Dentist	54 (55)	7 (7)	4 (4)	34 (34)	99 (100)

H_0: there is no difference amongst these frequency distributions.

H_1: there is a difference.

Critical X^2 value, at 0.05 and 9 df, = 16.92

$X^2 = 46.24$.

Therefore H_0 is rejected and H_1 is accepted.

To discover which of these distributions differ from the others, each distribution was compared in turn with all others by means of the chi-square test and the results are set out in Table 4.19.

TABLE 4.19

RAINY RIVER: ITEMS 5-8 -- CHI-SQUARE VALUES

	Women's coat	Furniture	Jewellery	Dentist
Women's coat	--	4.86	2.66	20.77 *
Furniture		--	1.14	17.20 *
Jewellery			--	20.71 *
Dentist				--

* Significant values (5 df at 0.05, critical value = 7.82).

The results indicate no difference in settlement choice in respect of the three goods and, also, indicate a strong difference in settlement choice in respect of the three goods and dental services.

The consonance in spatial behaviour in respect of these three goods demonstrated by lack of distance difference and similarity of settlement choice is emphasised by the strongly similar patterns demonstrated in Figures 4.9-4.12. The Fort Frances service areas fan out to cover *circa* two-thirds of the region and capture over sixty per cent of the trade involving movement. Emo and Rainy River together account for a small proportion of the remainder and Winnipeg accounts for slightly less than these two centres. Emo, under competition from Fort Frances, experiences slight competition from Winnipeg, while Rainy River experiences heavier competition from Winnipeg.

The dominance of Fort Frances indicated by consumer movement is reflected, in the case of women's coat, by that centre's service equipment. Fort Frances possesses thirteen retail outlets classified as apparel stores, whereas Emo and Rainy River have two

and one respectively. It might be expected that Emo and Rainy River would capture more of the market in their immediate vicinities but, in view of the patronage motivations identified (discussed after men's coats), the Fort Frances dominance is understandable.

One other feature requires comment: according to the evidence presented in Figure 4.10, Stratton plays the same role in furniture provision as Emo, as far as the dispersed population is concerned. There are neither furniture nor department stores at Stratton and Emo. Explanation of their reported use, therefore, relies upon erroneous reporting or variation in respondents' perceptions of furniture. Where the small settlements are patronised it may be asserted that items such as collapsible coffee tables or lamps, which are not considered to constitute furniture by the majority of the respondents, are being purchased from general stores.

The distribution of settlement choices in respect of dental services differs radically from the other three distributions and Figure 4.12 may be compared with Figures 4.9-4.11.

Firstly, the number of journeys is high (99, compared with 58, 60 and 78). Examining the actual pattern, the differences in settlement choice are occasioned by the very high use of Baudette, instead of Rainy River, and the use of International Falls, in addition to Fort Frances.

There are very few long-distance trips to Winnipeg and there are, then, three main service areas: that of Baudette, which emerges clearly from graphical representation; and those of Fort Frances and International Falls, which are difficult to differentiate on the basis of this graphical representation, but most of the longer

distance trips -- those originating just to the east of a zone between Stratton and North Branch -- appear to terminate in Fort Frances rather than in International Falls. Because of this difficulty of visual differentiation between the International Falls' and Fort Frances' service areas, they are considered as one. Two main service areas emerge: that of Baudette, which extends over the western third of the Rainy River rural area; and that of International Falls - Fort Frances, which predominates over the eastern two-thirds of the Rainy River rural area. The zone of cleavage is fairly distinct and occurs in the triangular-shaped area based on the Pinewood - Stratton axis with the apex at North Branch. Noticeably this cleavage-zone is farther to the east than the cleavage-zone between the Rainy River and Emo family doctor service areas, this spatial difference being partly explained, perhaps, by the relative insignificance of Emo and the longer trips involved in obtaining dental services at Fort Frances.

Both figures reveal a small number of trips which are difficult to explain: those to Rainy River and to Emo, since the analysis of service structure revealed no dental practitioners located in these places on a full-time basis; nor did the field survey indicate any establishments in either Rainy River or Emo which might house dental services on a part-time basis. A number of possible explanations for these apparent anomalies may be offered. The respondents may have erred; but this explanation is rejected since there was reported differential use (most/last), by some of the same respondents, of Emo and Rainy River on the one hand and Fort Frances and Baudette on the other. A more plausible explanation is that the patients were receiving some form of dental

treatment which required the presence of a doctor, and that doctor and dentist provided the joint service in Emo and in Rainy River. A third possible explanation is rejected: that a family doctor either performed some service in respect of teeth, or diagnosed a complaint which required subsequent dental treatment in another location; these leading to confusion in the response to the questions regarding the place where the services of a dentist were obtained. It is rejected because of the very specific wording of the question which draws an implicit distinction between general work performed on the teeth or bucal cavity and the services of a dentist. The trips to Emo and Rainy River have been accepted as accurate records of behaviour, and the appropriate distances have been entered in computations.

It is difficult to reconcile the heavy use of Baudette for dental services and the non-use of Rainy River. One explanation would stress that although the threshold can be met no dentist willing to practise in Rainy River can be found. But, even although it is in the United States, dentists have been found to practise in Baudette. No information is readily available on the size of the market in the United States tapped by Baudette-based practitioners; and, therefore, why Rainy River lacks dental service provision must rely on a suggestion of practitioner shortage combined with low market-size.

(9) Men's Coat

A distance of 9.8 miles (Table 4.3) separates the sample means of last buy and most buy distances but the rank-sum test

TABLE 4.20

RAINY RIVER: MEN'S COAT SETTLEMENT CHOICE

	FF	E	RR	W	O	Total
Last buy	37	7	12	5	10	71
Most buy	47	8	9	4	5	73

demonstrates that such a difference is not reflected in a comparison of the true means (Table 4.10). Moreover, a comparison of the two frequency distributions (Table 4.20) yields a value of $X^2 = 3.44$, which is not statistically significant at the 0.05 level with df 4 (critical value $X^2 = 9.49$). Hence, only most buy data are represented (Figure 4.13) and discussed.

The overall pattern is simple to describe: Fort Frances is the prime focus for consumers in the eastern two-thirds of the area and Emo's service area nests within the Fort Frances service area.[1] In the western third of the area Rainy River has developed a service area. Travel to Winnipeg originates between the Rainy River service area and the eastern third of the Fort Frances service area.

Women's and Men's Coats Compared

The rank sum test indicates that there is no difference between the mean distances travelled for women's coat and men's coats (Table 4.10).

The two distributions, set out in Table 4.21, may be compared.

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[1] Nesting here refers to service areas of the same item, compared with Christaller's idea of the service areas of different items.

TABLE 4.21

RAINY RIVER: WOMEN'S & MEN'S COATS SETTLEMENT CHOICES

	FF	E	RR	W	O	Total
Women's coat	47	3	3	5	2	60
Men's coat	47	8	9	4	5	73

$X^2 = 5.40$, and with 4 df critical value of X^2 at 0.05 is 9.49.

Therefore, there is no statistically significant difference between the distribution of settlement choices in respect of these goods.

Respondents (who were both male and female but primarily female) were asked to identify the most important factor influencing their decision as to which settlement to visit for the purpose of coat purchase. Since there is no difference in distance or settlement choice between men's and women's coats the lack of male-female differentiation does not invalidate the responses, the distribution of which is shown in Table 4.22.

TABLE 4.22

RAINY RIVER: COAT PURCHASE PATRONAGE MOTIVATION

Reason	No.
Quality	39
Price	32
Choice	26
Store-service	2
Opportunity to take a trip	2
Total	101

Quality, price and choice account for the vast preponderance of the responses. To combine the desire for as low a price as possible with the desire for a quality product and with an array of choice necessitates concentration of provision in larger settlements where stores may achieve economies of scale and large thresholds, primarily by catering to the nucleated populations within which they are located.

(10) Watch

TABLE 4.23

RAINY RIVER: WATCH SETTLEMENT CHOICES

FF	E	RR	W	O	Total
41	8	6	6	16	77

The distribution of settlement choices is summarised in Table 4.23 and the actual journeys involved are shown in Figure 4.14.

It can be argued that there should be a degree of consonance between the patterns of travel shown here and those shown for jewellery in Figure 4.11. The evidence presented in Table 4.10 indicates no statistically significant difference in the travel distances involved; it is, however, possible for a distance similarity to be maintained and for there to be a statistically significant difference between the distributions of settlement choices. Thus the watch distribution and the jewellery distribution (slightly modified from Table 4.18) may be compared by means of the chi-square test.

Apart from the fact that a greater number of consumers is involved (77 watch, 58 jewellery) the strongest difference between the two patterns is the use of the small settlements for watch purchases: for example, the use of Stratton, Pinewood and Morson. The use of these other centres, however, is not great enough to produce a statistically significant difference between the two distributions. (X^2 = 7.12, df = 4 at 0.05; critical value of X^2 = 9.49).

(11-19) Refrigerator-Hospital

The items from refrigerator to hospital in Table 4.10 are assessed as members of the same class on the basis of the ranking technique employed; moreover, none of these items differs to a statistically significant level in terms of the distances involved. In addition none of these items differs from the three goods subsequently listed in Table 4.10 (car insurance, men's shoes and doctor) in terms of distance relationships. The group extending from refrigerator to hospital is considered first.

Of these nine items, last buy and most buy distance data were obtained for seven of them. No differences exist between the last trip and most trip means of those goods tested: women's shoes, teenage girls' clothes and hospital (Table 4.7). In these cases and in the cases not tested, however, there exists the possibility that the distribution of settlement choices varies between last buy information and most buy information. The distributions of settlement choices are set out fully in Appendix 13. Before inter-item comparison may be effected, last buy and most buy distributions must

be tested for significant differences. These two types of data were obtained for seven items and are set forth in comparable distributions in Table 4.24.

TABLE 4.24

RAINY RIVER: SEVEN ITEMS -- COMPARISON OF LAST & MOST BUY SETTLEMENT CHOICES

Men's work clothes	FF	E	RR	O	Total
Last	32	16	21	10	79
Most	38	12	13	10	73
Women's shoes					
Last	31	6	18	9	64
Most	33	8	19	5	65
Bank					
Last	48	21	28	1*	98
Most	46	22	29	0	97
Teenage girls' clothes					
Last	17	2*	4	1*	24
Most	13	1	5	1	20
Drugs					
Last	30	43	21	3*	97
Most	31	45	21	1	98
Children's clothes					
Last	23	3*	14	1*	41
Most	15	2	9	3	29
Hospital					
Last	28	42	9	16	95
Most	32	46	14	6	98

* Derived expected value too low.

The first, second and last items listed in Table 4.24 may have their pairs of frequency distributions compared without

adjustment; for the intervening four pairs, however, expected values will fall below 2 in the cells indicated by asterisk. Thus some combining of observed values is required.

The final pairs of distributions compared and the results of the chi-square test are as follows:

RAINY RIVER: COMPARISON OF LAST AND MOST BUY SETTLEMENT CHOICES

Men's work clothes	FF	E	RR	O	T	X^2	df	c.v.*
Last trip	32	16	21	10	79	2.64	3	7.82
Most trip	38	12	13	10	73			
Women's shoes	FF	E	RR	O	T			
Last trip	31	6	18	9	64	1.47	3	7.82
Most trip	33	8	19	5	65			
Bank	FF	E & O	RR		T			
Last trip	48	22	28		98	0.04	2	5.99
Most trip	46	22	29		97			
Teenage girls' clothes	FF	E & O	RR		T			
Last trip	17	3	4		24	0.45	2	5.99
Most trip	13	2	5		20			
Drugs	FF	E	RR		T			
Last trip	30	43	24		97	0.12	2	5.99
Most trip	31	45	22		98			
Children's clothes	FF	E & O	RR		T			
Last trip	23	4	14		41	0.84	2	5.99
Most trip	15	5	9		29			
Hospital	FF	E	RR	O	T			
Last trip	28	42	9	16	95	5.99	3	7.82
Most trip	32	46	14	6	98			

* Critical value.

The results of the chi-square test show that not one of these pairs of distributions differs significantly, thus only the most trip

distributions are used in the following analysis.

None of the goods differs in terms of distance but it is possible for variation to exist amongst the frequency distributions of settlement choices. Each one of the nine distributions may be compared with all of the others by means of the chi-square test. The distributions to be compared are set out in Table 4.25.

TABLE 4.25

RAINY RIVER: INTER-ITEM COMPARISON OF FREQUENCY DISTRIBUTIONS

	FF	E	RR	O	Total
Refrigerator	43 (48)	8 (7)	12 (13)	29 (32)	92 (100)
Farm machinery	16 (23)	20 (29)	3 (4)	30 (44)	69 (100)
Men's work clothes	38 (52)	12 (16)	13 (18)	10 (14)	73 (100)
Women's shoes	33 (51)	8 (12)	19 (29)	5 (8)	65 (100)
Bank	46 (47)	22 (23)	29 (30)	0 (0)	97 (100)
Drugs	31 (32)	45 (46)	21 (21)	1 (1)	98 (100)
Hospital	32 (33)	46 (47)	14 (14)	6 (6)	98 (100)

The sixth item listed in Table 4.24 (teenage girls' clothes) and the eighth item listed (children's clothes) present problems. The low total number in each sample, and the low values in the Emo and "other" cells, renders comparison between them and the others invalid; and it renders comparison between the two items themselves invalid, so long as the distributions remain in their present form.

Thus these two items have been omitted from Table 4.25 and are examined separately from the other items as follows:

The chi-square test may be used to test the following hypotheses for both distributions in turn: .

(1) H_0: There is no difference in settlement choices

H_1: There is a difference in settlement choices

Result: Teenage girls' clothes $X^2 = 19.20$

Children's clothes $X^2 = 14.99$

(Critical value = 7.82, df = 3 at 0.05 level).

Thus H_1 is accepted.

(2) H_0: Fort Frances is not preferred over all settlements

H_1: Fort Frances is preferred over all other settlements

Result: Teenage girls' clothes $X^2 = 1.8$

Children's clothes $X^2 = 0.02$

(Critical value = 7.82, df = 3 at 0.05 level).

Thus H_0 is accepted.

The remaining seven items may now be compared with each other in turn and the chi-square values yielded are set out in matrix form in Table 4.26.

With df = 3, at the 0.05 level, X^2 must equal to or greater than 7.82. To simplify Table 4.26 the values are replaced with the dichotomous symbols 0 and 1, where 0 represents no difference and 1 a difference (Table 4.27).

TABLE 4.26

RAINY RIVER: MATRIX OF CHI-SQUARE VALUES

	Ref	FM	MWC	WS	Bank	Dru	Hos
Refrigerator	--	20.08	8.33	15.65	42.59	64.86	43.48
Farm machinery		--	27.13	40.45	62.86	51.58	34.71
Men's work clothes			--	3.49	16.75	33.28	18.22
Women's shoes				--	14.85	29.67	21.82
Bank					--	14.21	21.04
Drugs						--	4.96
Hospital							--

TABLE 4.27

RAINY RIVER: MATRIX OF DIFFERENCES

	Ref	FM	MWC	WS	Bank	Dru	Hos
Refrigerator	-	1	1	1	1	1	1
Farm machinery		-	1	1	1	1	1
Men's work clothes			-	0	1	1	1
Women's shoes				-	1	1	1
Bank					-	1	1
Drugs						-	0
Hospital							-

Patterns of similarity and difference in the group under scrutiny clearly emerge. The first two items listed in Table 4.27 (refrigerator and farm machinery) differ both from each other and from all other items. Thereafter, there is a basic split: there is no difference in settlement choice as far as apparel goods are concerned

(men's work clothes and women's shoes) and the patterns of movement for these may be described and analysed together; the similar patterns of movement for apparel goods differ from the movement patterns for bank, hospital and drugs; moreover, whereas there is a similarity between the patterns of movement for drugs and hospital, both of these differ from that of bank, rendering description and analysis more complicated.

Both farm machinery and refrigerator differ from the other five items principally in that the number of consumers' trips to settlements other than the three main service points, to obtain these two goods, are absolutely and proportionately large (Table 4.25 and Figures 4.15 and 4.16). This similarity is heightened by the fact that the high proportions of consumers visiting "other" settlements are distributed amongst the small service points within the area: the same small service points for both items, apart from the use of Sleeman for refrigerator and Barwick for farm machinery. But these two distributional patterns, while differing from distributional patterns of all other items considered in Table 4.25 also differ from each other. The main points of difference between the two are: the greater proportion of the total number of respondents patronising settlements other than the three main ones (*circa* 43%, farm machinery; *circa* 32% refrigerator); and the greater use of Emo for farm machinery, compared with use of Fort Frances and Rainy River, and the greater use of Fort Frances and Rainy River for refrigerator, compared to Emo.

Both patterns of movement are related to a diffuse system of supply. In the case of farm machinery it may be speculated that the diffuse system of supply is related to servicing and repair needs, there being a fairly regular and continual need for either the supplier

to visit the purchaser's farm to perform servicing or to effect small repairs, or for the purchaser to take farm equipment in to the supply point for major overhaul or large repairs. Such a specualation is not fully supported by the evidence presented in Figure 4.15: there is considerable evidence of consumers bypassing the closest supply point, often a large settlement, in favour of a small settlement further away. If proximity to the point of purchase for subsequent service was a more comprehensive and valued explanation, a greater degree of patronisation of the closest supply point might be expected. If, however, it were a common practice to purchase farm machinery from an agent of a firm with several agents in the area, then it would be possible for machinery to be purchased at more distant places of supply and to be serviced from closer places. The diffuse pattern of supply would, then, be related to the needs of repair and service.

The needs of service are less useful in speculation regarding the diffuse pattern of consumer movement for, and supply of, refrigerators. Certainly, proportionately less consumers patronise "other"[1] supply points, compared to farm machinery, but the proportion is still high in comparison with the other items listed in Table 4.25. Electrically powered refrigerators rarely break down and need infrequent servicing (the writer's has functioned for five years without any attention). But, in rural areas, many refrigerators are powered by propane gas and such appliances require more frequent attention than electrically powered refrigerators. Thus the explanation of the diffuse supply pattern may be related to the necessity of regularly purchasing supplies of propane gas from the dealer and to the need

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[1] "other" denotes a class of supply points.

for frequent inspection and servicing of the refrigerator.

Some explanation of the greater use of Emo for farm machinery must be attempted. In terms of location alone Emo is more conveniently situated as a supply point for the entire dispersed population than are Fort Frances and Rainy River. In terms of items required by both dispersed and nucleated populations Fort Frances might be expected to possess the greatest supply capacity because of its own disproportionately large population -- compared to either Emo or Rainy River, which in turn is related more to secondary economic activities rather than to tertiary activities. In cases of items peculiar to the dispersed population, such as farm machinery, it is to be expected that the location most accessible to that dispersed population will possess a heightened service role; and this is true here for Emo. (It should be noted that thirteen residents out of the sixty-seven in the Fort Frances sample reported farm machinery purchases. Of these, four reported being engaged in agriculture and the other nine, it may be speculated, either farm on a part-time basis or confused garden machinery with farm machinery. Further, of the thirteen, only three purchased the machinery in Fort Frances; whereas five purchased it in Emo, which suggests that their farms might be more accessible from Emo rather than from Fort Frances, the location of their residences.)

One other point requires comment: although both refrigerator and farm machinery purchases involve proportionately heavier use of "other" centres and ostensibly a greater proportion of short-distance trips, there is no statistically significant difference between the distance data for these two items and the distance data for an item involving minimal use of "other" centres and heavy use of the three

main internal supply points of Fort Frances, Emo and Rainy River: for example, bank, in the case of which there is no use at all of "other" centres.

The remaining five items have one feature in common (in addition to lack of distance difference): the proportion of consumers using "other" centres is absolutely low compared to the two items just considered; and the proportions within this reduced group vary over a small range, from nought per cent for bank to fourteen per cent for men's work clothes.

Earlier it was argued that this reduced group of five items could be considered as comprising an apparel group (two items) and a service group (three items: bank, hospital, and the medically oriented good, drugs).

A comparison of Figures 4.17 and 4.18, in conjunction with the appropriate values in Table 4.25, shows that in each case over fifty per cent of the respondents purchase apparel goods in Fort Frances; moreover the Fort Frances service areas extend to approximately half-way between Emo and Rainy River. Rainy River's two service areas extend over the western one-third of the region and, whereas patronage of Emo varies more on a proportional basis, the Emo service areas are set within the Fort Frances service areas.

On the other hand, a comparison of Figures 4.19-4.21 and the appropriate values in Table 4.25 shows Emo with a proportionately larger share of the markets and more strongly developed service areas, more strongly developed particularly to the west of that settlement and at the expense of Fort Frances rather than Rainy River.

Two explanations may be offered for these two basic patterns. In the case of the apparel goods, it may be asserted that the consumer

demands an array of styles and standards of quality from which to choose. In turn this involves either a few large retailing outlets -- each of which contains a wide array of apparel goods -- or a larger number of smaller retailing outlets -- each of which contains a restricted array of apparel goods, but when taken *in toto* present a wide array from which the consumer may choose. It would seem that both of these explanations involve establishments in seeking accessibility to as large a threshold as possible; and, therefore, in respect of apparel goods, the urban population of Fort Frances exerts a locational pull on apparel establishments.

The same influences would not seem to apply with the same force to the items in the other sub-group (bank, drugs, and hospital). In the case of banking, the issue of selection and comparison need not apply. Indeed, given that Emo seems to operate as a service centre for the agricultural component of the dispersed population, the development (in Emo banks) of specialised talents directed towards comprehending the financial problems of farmers, in terms of credit purchasing of equipment or farm improvement for example, might explain the increased role of Emo.

In the case of drugs and hospital, the issue of scale of provision and selection would seem to have little relevance. For both of these items Emo has captured a considerable proportion of the dispersed population and has added a strong eastern component to an even stronger western component. In respect of these two items there is a pattern of utilisation of nearest service centre resulting in three well-developed service areas with clearly recognisable zones of cleavage and little unnecessary travel. It may be asserted that the factor of accessibility is of considerable importance.

Such an explanation is incomplete: it provides no connection between hospital and drugs other than that of accessibility. At the intuitive level it may be suggested that the family doctor may provide a link inasmuch as most drugs are purchased in response to a doctor's advice, generally by authority of prescription issued by the doctor and inasmuch as most doctors tend to refer their patients to the same hospital. The services of a family doctor are provided in Emo and the pattern of consumer movement to obtain the services of a family doctor, over the whole Rainy River Region, is almost identical to movement patterns for hospital and drugs. Moreover, all three frequency distributions of settlement preference exhibit a high degree of similarity (see Table 4.28 for doctor values), there are no differences in the distances involved. It is suggested, then, that movement for doctor's services provides a link between movement for both drugs and hospital and acts as the main influence in producing the hospital-drug similarity.

(20-22) Car insurance, Men's shoes and Family doctor

On the basis of the information presented in Table 4.10, three items (car insurance, men's shoes and family doctor) are grouped: all three exhibit no statistically significant differences amongst their own mean distances and all three involve greater mean distances than the same two items (groceries and meat). Accordingly these three items are described and analysed together.

For all three items settlement choice data of two types, last buy and most buy, were collected. For each good the two frequency distributions are set out in Table 4.28.

TABLE 4.28

RAINY RIVER: THREE ITEMS -- COMPARISON OF MOST AND LAST BUY SETTLEMENT CHOICES

	FF	E	RR	O	Total
Car insurance					
Last buy	27	33	28	2	90
Most buy	27	34	29	1	91
	(30)	(37	(32)	(1)	(100)
Men's shoes					
Last buy	28	17	28	13	86
Most buy	33	17	26	8	84
	(39)	(20)	(31)	(10)	(100)
Family doctor					
Last buy	30	50	13	7	100
Most buy	26	52	17	5	100
	(26)	(52)	(17)	(5)	(100)

With df = 3, at the 0.05 level, X^2 (Men's hoes) = 1.62. With a critical value of 7.82, it may be asserted that the two frequency distributions for men's shoes are similar. Moreover, visual comparison of the pairs of frequency distribution of the other two items does not suggest enough difference to necessitate application of the chi-squre test; hence, the further consideration of the items, in terms of settlement choice, is confined to most buy data.

It has already been established that variation in settlement choice amongst items can co-exist within a basic similarity of distances. Accordingly, the three frequency distributions are tested against one another by means of the chi-square test. The results are set out, in matrix form, in Table 4.29.

TABLE 4.29

RAINY RIVER: MATRIX OF CHI-SQUARE VALUES

	CI	MS	FD
Car insurance	--	11.47	9.15
Men's shoes		--	19.88
Family doctor			--

With df = 3, at the 0.05 level, X^2 must equal or be greater than 7.82. All three values in Table 4.29 clearly exceed this critical value, therefore the variations in settlement choice amongst the three items must be examined in greater detail.

The spatial expressions of these three frequency distributions are set out in Figure 4.22 (Car insurance), Figure 4.23 (Men's shoes), and Figure 4.24 (Family doctor). A number of similarities and differences amongst the three patterns may be pointed out. Consolidated family doctor service areas and fairly consolidated car insurance service areas have developed, in contrast to the interlocking and overlapping men's shoes service areas. Travel to the United States is restricted to movement from the western part of the region for the services of a family doctor, to Baudette (paralleling similar but more substantial movement for dental services); there is no regular movement to the United States for either car insurance or the apparel good. On the other hand there is quite a large percentage of movement (10%) for men's shoes to smaller centres within the region: to four smaller centres in all -- La Vallée, Devlin, Stratton and Morson. This requires comment, because the highest percentage amongst the three items recorded by

Fort Frances is the apparel good and the same arguments that have been earlier advanced in respect of Fort Frances and apparel goods also may be invoked here. It is posited that these arguments are valid in the case of men's shoes and that use of the smaller centres reflects purchases of standardised industrial working boots, for the purchase of which the consumer neither desires nor needs comparison of styles and prices.

One more feature requires comment particularly because earlier it was suggested as a link for two other items: the apparently disproportionate share (over 50%) of the market captured by Emo in respect of family doctor. It may be argued that this represents a sensitivity to both distance and time on the part of consumers. Time is particularly important in cases of emergency, whether the emergency involves movement in of the consumer or travel out of the doctor. Further, in terms of general medicine, the consumer will gain little by making longer trips to Fort Frances as opposed to Emo. Also, it may be speculated that the Emo doctor is prepared to make rural house calls and this factor influences patronage of his Emo office.

(23-25) Television, Groceries and Meat

The last three items listed in Table 4.10, television, groceries and meat, are considered to constitute a class on the ground of similarity of distance data amongst themselves and on the ground of possessing the lowest ranked distance data.

For two of these items (groceries and meat) both types of settlement choice data were collected but for television only

last buy data (Table 4.30).

TABLE 4.30

RAINY RIVER: THREE ITEMS -- SETTLEMENT CHOICES

	FF	E	RR	O	Total
Television					
Last trip	24	16	12	26	78
	(31)	(21)	(15)	(33)	(100)
Groceries					
Last trip	35	12	12	42	101
Most trip	41	14	10	35	100
	(41)	(14)	(10)	(35)	(100)
Meat					
Last trip	33	12	13	27	85
Most trip	36	9	11	24	80
	(45)	(11)	(14)	(30)	(100)

Comparison of both types of data yields the following values:

$$\text{Grocery } X^2 = 1.56$$

$$\text{Meat } X^2 = 0.71$$

with df = 3, 0.05 level, critical value 7.82; accordingly only most buy data are used in further description and analysis.

Comparison of the three frequency distributions by the chi-square test yields the following results, set out in matrix form (Table 4.31).

TABLE 4.31

RAINY RIVER: COMPARISON SETTLEMENT CHOICE DATA

	TV	Groc	Meat
Television	--	3.37	4.42
Groceries		--	1.26
Meat			--

With df = 3, 0.05 level, and a critical value of 7.82, there is no difference amongst the settlement choices. Since "other" constitutes such a large proportion of each total, however, each pattern of consumer movement is analysed.

It is not surprising that two of these three items (groceries and meat) share the characteristic of possessing the lowest mean travel distances of all goods. It is more surprising that television is ranked so low in terms of distance.

Examination of the frequency distributions suggests the cause of the low distances involved in all three cases: the high percentage (*circa* 33%) of consumers utilising settlements other than the three main service centres for the region. Figure 4.25 (Television), Figure 4.26 (Groceries) and Figure 4.27 (Meat) show that, except for four trips in the case of television, all of the trips classified as "other" are short distance trips; and to centres within the region, for there are no trips to either Baudette or International Falls in the United States. That no trips to the United States for television are shown is perhaps understandable in view of the high customs duty involved for such costly goods. In the case of meat, on the other hand, existence of the inter-state

boundary would not prevent a consumer travelling to, for example, International Falls or Baudette for meat and transporting it back over the boundary into Canada. Provided that the meat is not for resale casual importation of meat, under twenty pounds in weight in any one load, is allowed duty-free. The importation into Canada of quantities of meat in excess of twenty pounds would still not attract duty but the meat would have to be accompanied by a certificate of inspection from the United States Department of Agriculture asserting its quality. Since there is no government regulation prohibiting the importation of meat and no government-imposed duty on casual importation, it must be assumed that the pattern of non-use of United States' service centres reflects the Rainy River consumers exercising choice and deciding to purchase meat within the area. In view of the pattern of travel for meat within the area, identified below, it may be suggested that Baudette and International Falls offer no more in the way of array or quality to persuade the consumer to make the slightly longer trip to these centres.

Establishments selling and servicing television sets are well distributed throughout the area. At first sight this may appear unusual or seem to be against expectations, for televisions are purchased relatively infrequently, perhaps once every two years or more, and are costly items -- *circa* $200 upwards. They require servicing more frequently, however, occasioning a trip to the point of service on the part of the consumer (transporting the set) or a trip from service point to the home on the part of dealer/repair man. Again, television sets do not break down all that frequently but once one has, speed of repair is the central issue; and a widespread distribution of retail outlets and service points aids this.

Add to this the fact that most retail outlets for television sets are also retail outlets for other electrical appliances -- usually radios and record players -- and that most outlets provide some form of servicing, under the same issues of speed as television sets, and the fairly wide distribution may be explained.

The spatial patterns for both meat and groceries are very similar: both involve only one well-developed service area (that of Fort Frances) and both goods seem to be purchased at the same places by the same consumers. The multiplicity of short trips to the large number of small places is indicative of the frequency with which the goods are required and consumers' perceptions of the ranges of these goods. There are a few long distance trips to Fort Frances, particularly for groceries, which may be attributed to multi-purpose trips, of the weekly variety and involving purchases and entertainment.

Discussion

The findings, and the analysis of them, relating to the spatial travel behaviour of the dispersed population of the Rainy River district raise and clarify both methodological and substantive issues.

The methodological issues embrace the nature of the relationship between the last occurrence of an event and generalisations based upon a number of events; the nature of the relationship between sample values and the values for the populations from which the samples were drawn; the applicability of parametric and non-parametric tests to travel distance data; and the degree of specifity required in item-identification.

To base studies upon the recollection of the instance of an event -- in this study, place of last purchase -- gains the advantage of accuracy of respondent recall and facilitates question-wording and research-design. The major objection to the procedure is that the respondent's last instance of the behaviour may be inconsistent with his behaviour over a longer period of time. To examine only the respondent's generalisation of his behaviour over a longer time-period places heavy reliance upon the respondent's ability to recall all variations in his behaviour and accurately to incorporate these in his generalisations. There are two possible ways of avoiding this dilemma. The time-period over which generalisation is required may be limited but the selection of this time-period is highly subjective and may raise other problems. In this type of study, also, information on first-choice and second-choice centres may be elicited (Golledge *et al.*, 1966) but again this involves generalisation, at two levels of recall. The findings for the dispersed population of the Rainy River District indicate that there is no difference, in either settlements visited or distances travelled, between the last instance of the behaviour and generalised accounts of the behaviour. Assuming accuracy of respondent recall and reliability of respondent differentiation, the applicability of this finding for Rainy River to other areas may be pondered: the strong correspondence may be applicable only to Rainy River, or only to areas similar to Rainy River and to dispersed populations. It would seem reasonable to expect a close correspondence between the two types of behaviour in situations where the individual has little chance greatly to vary his spatial behaviour. In respect of some of the items examined in the Rainy River District, there is little

opportunity for variation, for example in respect of specialised medical services or the services of optometrist and lawyer. Equally, for other items -- consumer goods and less sophisticated services -- there apparently is the opportunity for the consumer to vary his behaviour in the respect of the same item. The findings, however, reveal no significant variations of this type.

This finding is true of the whole populations from which the samples employed here were drawn. Examination of sample values alone often suggests variations of considerable magnitude, between not only last buy and most buy behaviour but also between behaviour in respect of different items in terms of settlements patronised and distances travelled. Infinite care must be taken with sample values, especially when the total number of items in the samples is low.

In this treatment of sample values both parametric and non-parametric tests are available. Parametric tests are better known and more widely used and they constitute a more powerful method of analysing data. They do, however, involve assumptions about the distributions of the parent populations and rarely are these assumptions tested. The sample populations drawn from the Rainy River District are shown to require analysis by means of non-parametric tests and one instance of a suggestion of difference between two types of sample mean, based upon assumption of normalcy, is shown, by non-parametric tests, to be invalid. Moreover, the ranking of items based on sample values employed in parametric tests is shown to be different from a more elaborate procedure based on a non-parametric test. A precise measure of the relationships between ranking based upon parametric and non-parametric approaches would require prior application of the test standard error of the

difference between two sample means to the appropriate summary measures of the items the sample means of which are listed in column 2 of Table 4.32. Then two rankings, both of whole populations, could be compared by means of Spearman's test for the rank-order coefficient of correlation. Cost factors, however, prohibit a series of tests (standard error of the difference) of these dimensions. Accordingly, instead of the rankings of two sets of whole populations being compared, it is necessary to compare the ranking of whole populations (based on rank-sum test, column 1, Table 4.32) with that of sample populations (based on sample means, column 2, Table 4.32). The result of the comparison, as expressed by the rank-order coefficient of correlation, is better regarded as an estimate of the relationship between the rankings rather than as a precise measure. Whereas the degree of correspondence, as expressed by the rank-order correlation coefficient of $p = + 0.92$, between the two sets of rankings is strong, a number of individual items vary considerably in their placings. Considering only pairs of rankings in which no member of the pair occupies a tied rank in its own set, optometrist and lawyer (both five places) and watch (six places) are the most severe examples.

Spearman's test may also provide a measure of the variation between rank-sum test ranking of items (column 1) and visual ranking of item (column 3). Although the latter ranking does contain tied ranks, where the writer was unable satisfactorily to refine the visual ranking process, it should be emphasised that the ranking in column 3 represents a process based upon sample data and that the comparison of columns one and three represents a population-sample comparison. The test yields a value of

$p = + 0.87$ (significant at the 0.05 level), a surprisingly high positive correlation in view of the extreme subjectivity of the visual ranking process. Examining individual discrepancies, the most glaring examples are the low rankings accorded refrigerator and farm machinery in the visual analysis, rankings stemming from the visual similarities between the patterns of movement for these two items and that for television. Another item, men's shoes, is severely misranked on a visual basis, being accorded a higher positioning due to perceived similarities with men's work clothes and women's shoes.

In the instance of Rainy River District data, then, it appears that parametric tests, based on means and standard deviations, would not have led to gross distortions of overall rankings of items but individual items may have been thereby severely misplaced. The same conclusion appears applicable to ranking based upon visual impression.

Some of the reported journeys to purchase constitute anomalies because the survey of establishments indicated no supply of that item in the places at which purchase was reported: for example, to Fort Frances for specialist medical services; to Gameland for car; to Emo and Rainy River for lawyer; to Morson for women's coat; to La Vallée, Barwick, Stratton and Morson for furniture, to Stratton for jewellery; and to Devlin for women's shoes. Assuming accuracy of responses, the source of the anomalies seems to reside in too general designation of the item in the question-wording that allows inclusion in respondents' minds of items, and journeys to obtain these items, different from those it

TABLE 4.32

RAINY RIVER: COMPARATIVE RANKINGS OF ITEMS

	1	2	3
	Rank-Sum	Sample Mean	Visual
Medical specialist	1	1	1
Optometrist	2	7	3.5
Car	3	2	2
Lawyer	4	9	3.5
Women's coat	6.5	3	8.5
Furniture	6.5	5	6
Jewellery	6.5	6	6
Dentist	6.5	10	10
Men's coat	9	8	8.5
Watch	10	4	6
Refrigerator	15	11	20
Farm machinery	15	13	20
Men's work clothes	15	14	12
Women's shoes	15	16	11
Bank	15	18	16
Teenage girls' clothes	15	12	22.5
Drugs	15	21	16
Children's clothes	15	15	22.5
Hospital	15	17	16
Car Insurance	21	20	16
Men's shoes	21	22	13
Family doctor	21	23	16
Television	24	19	20
Groceries	24	24	24.5
Meat	24	25	24.5

was intended to identify by the question-wording. The general effect of inclusion of such items and visits is to produce greater variation in places visited and in distances travelled than would be the case with more precise item-identification, such as using the term "chesterfield" instead of the term "furniture". It has been shown, however, that explanations of apparently anomalous behaviour can be adduced. Further, to limit the response to very specific items assumes that all respondents have similar consumption patterns. For example, to elicit information on chesterfield

purchases may give a very precise result in terms of this product but the movements of a possible part of the population with no consumption of the product, and moreover a part that may substitute another specific product to perform the same function as a chesterfield, would be excluded. Given the possible variations in demand, stemming from variations in ethnicity, income and occupation, on balance it seems reasonable to leave the question more loosely phrased.

The substantive issues encompassed by the findings relating to the spatial aspects of consumer behaviour in the Rainy River District involve the relationship between distance travelled and time taken; the variation between travel for goods and travel for services; the relationship between travel and occurrence of opportunities for satisfying demand; the relationship between travel and use of catalogues; and the information yielded on service centres and service points.

In the calculation of the travel times involved in the patterns of consumer's spatial behaviour time was regarded as a function of distance, modified by local maximum speeds for motor vehicles and established mean speeds over different types of route surface. Variations in permitted speeds and route surfaces were found insufficient to destroy strong correlations between travel times and distances. So strong were the relationships that travel distance alone was used in subsequent analyses.

Only one clear break occurs in the array of travel distances for the twenty-five items, between those involved in securing specialist medical services and those involved in obtaining all other items. The array of sample means for the latter

twenty-four items appears to constitute a continuum, and groupings of items based upon consumers' travel distances are achieved by means of an unusual technique. A variety of relationships between distance travelled and places visited is shown to exist. Two items, for example, could be differentiated from each other on the basis of exceeding the travel distances of differing numbers of other items; yet these two items could themselves involve similar distances and similar patterns of settlement choices. Equally, two items classed as a belonging to the same group, on the bases of similar travel distances and exceeding similar numbers of other items' travel distances, could demonstrate differences in settlement choices. There are two explanations of this feature: either the number and locations of consumers involved in the purchase of both items is strongly similar and consumers exhibit a strong sensitivity to distance as they travel to different settlements; or the number of consumers and their locations vary between the items in such a way that different patterns of travel between the two items are not reflected by distance differences.

There is evidence of considerable variation between the travel patterns for goods and those for services. The Canada-United States boundary seems to operate as an effective mechanism in discouraging travel to centres in the United States, particularly in Minnesota, to obtain goods. Although goods are generally cheaper in the United States and although the distances to Baudette and International Falls would add little to purchase prices of goods, as would bridgetolls, the heavy custom's duty involved in importation of goods into Canada from the United States more than offsets any initial gains in lower selling prices. On the other hand, custom's

duty is not involved in services obtained in the United States and there is evidence of considerable use of United States' centres in instances where services appropriately may be performed in the United States and where demand apparently outstrips supply within the Rainy River District.

The influence of the nucleated population of Fort Frances upon the location of certain sophisticated services and certain goods is readily demonstrated. Where the urban environment and the urban population act as a positive locational influence on establishments, through the necessity for inter-item consultation (lawyers, for example) or through economies of scale (provision of array of choice -- fashion clothing, for example), a location with a lower degree of accessibility in terms of the whole spread of the dispersed population draws consumers from over the whole region and causes consumers to travel long distances. Where the urban environment and urban population do not greatly influence the locations of establishments, in the cases of less sophisticated services (bank, for example) and standardised goods, accessibility considerations produce a more diffuse pattern of supply emphasising Rainy River, and Emo particularly, as well as Fort Frances. Emo seems to emerge as *the* service centre where the peculiar needs of the dispersed population are concerned.

At the intuitive level it seems possible that there might be a relationship between distances travelled and the use of catalogues. Purchasing items by means of catalogues may be interpreted in two ways: either that the respondent is beyond the range of the item; or, for respondents within the range of the item, as a means of avoiding travel and perhaps as a way of increasing the

array of choice.

Of the 102 respondents in the sample, fifty-two reported purchases by means of catalogues in the month preceding the interview and over seventy per cent of these purchases involved adult fashion clothing or children's clothing. Only six of the respondents claimed never to purchase items by means of catalogues and the principal reasons for the other ninety-six were as follows:

Goods not available locally	14
Saves travelling	58
Array of choice	8
Price	13
Money back guarantee	1
Other	2
Total	96

It would appear that the overriding general reason for the use of catalogues is to avoid travel. It remains to be shown whether this general reason may be associated with variations in distances travelled. The demonstration is difficult because there are two, equally valid, expected relationships. Firstly, it may be expected that items involving consumers in a high mean travel distance will be associated with a high proportion of catalogue purchases, because catalogue-buying does not constitute the only way of obtaining the item. In other words, some consumers travel long distances for an item; other consumers avoid the long distances and use catalogues. Alternatively, it may be expected that items involving consumers in a high mean travel distance will be associated with a low proportion of catalogue purchases, because

catalogue purchases are not affecting the distances travelled for these items. For both expectations the appropriate reverse argument holds true in the first case, a low mean travel distance will be associated with a low proportion of catalogue purchases; and in the second case, a low mean travel distance will be associated with a high proportion of catalogue purchases. Table 4.33 includes only items for which catalogue purchases were recorded. (It could be argued that additional items, for which no purchases were recorded, should be included on the ground that catalogue -- or postal -- purchase could be expected but that the sample, by chance, failed to reveal an instance.) The items are ranked in Table 4.33 (column 1) on the basis of the relative mean distances consumers travel (Table 4.10). Also shown are the total purchases of the item (column 2), the total purchases of the item by catalogue (column 3), and the percentage that catalogue purchases constitute out of total purchases (column 4). The ranks of the items based on the first possible expectation (high distance-high catalogue purchase) are shown in column 5; and those based on the second expectation (high distance-low catalogue purchase) are shown in column 6. Application of the Spearman rank-order coefficient of correlation test yields a value of $p = + 0.36$ for columns 1 and 5, and a value of $- 0.24$ for columns 1 and 6. Both values are insignificant at 0.05. The lack of a significant correlation points up the difficulty of applying a generalised statement to particular cases and the generalised statement about distance may itself be the cause of two valid but contradictory expectations. The relationships that may be determined from Table 4.33 tend to suggest that there is a relationship between

TABLE 4.33

RAINY RIVER: DISTANCE-CATALOGUE COMPARISON

Item	1 Rank Table	2 Total Purchases	3 Total Catalogue/Post	4 Cat. as % of Total	5 Ranks Cat.	6 Ranks %
WC	2	95	35	37	2.5	11.5
Fur	2	80	20	25	5	9
Jew	2	66	8	14	9	5
MC	4	95	22	23	7	7
Wa	5	81	14	17	8	6
Ref	8.5	98	6	6	12	2
FM	8.5	70	1	1	13	1
MWC	8.5	96	23	24	6	8
WS	8.5	95	30	32	4	10
TGC	8.5	35	15	43	1	13
CC	8.5	46	17	37	2.5	11.5
MS	12	96	12	13	10	4
TV	13	85	7	8	11	3

catalogue purchases and distance travelled, but it is exceedingly complex. For example, the distances involved in purchasing women's coat and teenage girls' clothes are sufficiently different for the two items to occupy different ranks in column 1 (Table 4.33); but whatever expectation is adopted, both of these items are tied in rank in terms of catalogue purchases (columns 5 and 6 in Table 4.33). Either the use of catalogues has no or little effect on the distances involved in women's coats purchases but does have an effect on the distances involved in teenage girls' clothes, or vice-versa. The example of these two items suggests that no simple linear relationship exists between sets of distances travelled and levels of catalogue purchases.

Despite the methodological difficulties provided by question-wording and the possibility of variable response, the findings for the Rainy River District reveal a greater use of

small service centres for items other than meat and groceries than the survey of establishments suggested would be the case; for example, refrigerator, television, and clothing. In part this is a criticism of the classification employed in the establishment survey but the findings do point up the necessity for examination of both service centre and consumer behaviour. It is dangerous to infer the latter from the former.

A comparative visual examination of all of the patterns of movement in the Rainy River District leads to a general impression of the consumer's sensitivity to distance. For items where there is the possibility of choice *within* the District, there appears to be a tendency for those items associated with higher travel distances to exhibit more instances of consumers bypassing the first apparent opportunity and for items associated with lower travel distances to exhibit a greater degree of consumers utilising the nearest opportunity. At another level there appears to be a greater evidence of consumers bypassing first opportunity where goods conceivably purchased infrequently are concerned; and of consumers utilising nearest place for items conceivably purchased frequently and on a regular basis or where time may be of the essence.

LAKEHEAD

Description of the Area

The Lakehead dispersed population is irregularly distributed over an area stretching from the Canada-United States boundary in the south to the uneven edge of the Canadian Shield in the north; and the distinct eastern boundary of the area

provided by the Lake Superior shoreline contrasts with a vaguer junction of fluvio-glacial and till deposits with the Canadian Shield in the west. The flattest land is provided by the valley of the River Kaministikwia and its principal tributaries, notably the Slate River, and it is here that the most concentrated rural settlement is found. Rural settlement is sparser and more discontinuous on the flanks of the Nor'Wester range and on the periphery of the low-lying ground where the togography becomes broken and uneven, with rock outcrops diversifying the soil cover. There are more paved roads in this area than in the Rainy River area and these act as the main channels of movement for the dispersed population.

The existence of the two fifth order centres of Port Arthur and Fort William has inhibited the development of any level of service centre other than the first order: Jumbo Gardens, Kaministikwia, Murillo, Kakabeka Falls, Rosslyn,Nolalu, South Gillies (Figure 4.28). There are, however, many single establishments lining the principal roads (Chapter 2) but these are too widely-separated to be considered as service centres. It is thought that most of these are directed at tourists because, as is shown in subsequent sections of the chapter, most of the dispersed population obtains most items in either Port Arthur or Fort William or in first order centres.

It is shown in Chapter Five that the influence of Port Arthur and Fort William extends for over two hundred miles to the east of this area and for at least one hundred miles to the west. Accordingly this area must be considered as being set within these wider tributary areas.

Ordering the Items

As with the consumers in the Rainy River area, consumers' travel distances, travel times and settlement choices were collected, for the same array of items, in the rural area adjacent to the cities of Port Arthur and Fort William.

The first task was to search for discrepancies between travel distances and travel times. In the case of the Rainy River data, sets of sample travel distances and sample travel times for each item were compared by means of the Pearson Product Moment Coefficient of Correlation, and the value p was presented for each item in the array. It did not prove possible to apply this procedure to the Lakehead data, because the number of pairs of data constituting the sample for some of the items in the array exceeded the capacity of the work spaces in the Advanced Programming Language (APL) system. A less satisfactory procedure was followed, less satisfactory because of the potential unreliability of sample means: the items in the array were ranked, in descending order, according to the magnitude of the sample distance mean and the sample time mean. (All of these sample values, and others, are set out in Appendix 12.) Certain difficulties arose because, for most (eighteen) of the items in the array, sample distance and time means were available in respect of last buy and most buy behaviour, but for a few items (seven) in the array sample distance and time means were available for only last buy behaviour.

Analysis of the Rainy River data revealed no differences between last buy distances and most buy distances for the same item; to the extent that where last buy data only were available

they were compared with most buy data for other items. At the intuitive level it appears that the array of settlements amongst which the dispersed population at the Lakehead may make a choice in connection with consumption and travel is more restricted than in the Rainy River District; therefore, it seems reasonable to assume that there will be even less discrepancy between last buy and most buy behaviour at the Lakehead compared to Rainy River. Comparison of distance and time, nevertheless, has been approached in several different ways, to guard against fallacious intuition.

The test employed to measure the degree of correspondence, in each approach, is Spearman's test, Rank-order Coefficient of Correlation, whereby absolute values are utilised to determine rank, and the rank-values constitute the data inputs.

The formula employed is

$$p = 1 - \frac{6 \sum d^2}{N (N^2 - 1)}$$

where p = the correlation coefficient

d = the difference between rank values

N = the number of pairs of observations

(Ferguson, 1959, pp. 179-181).

Firstly, the sample means of distances and times of those items for which only last buy data were collected are compared. The actual values, with ranks in parentheses, are set out in Table 4.34.

TABLE 4.34

LAKEHEAD: LAST BUY MEANS (DISTANCE AND TIME) COMPARISON

	Distance*		Time**	
	$\bar{x}$	Rank	$\bar{x}$	Rank
Television	14.5	(1)	17.3	(1)
Car	14.1	(2)	17.0	(2)
Farm machinery	13.4	(3)	17.1	(3)
Refrigerator	12.0	(4)	14.6	(4)
Watch	11.6	(5)	14.1	(5)
Furniture	11.3	(6)	13.9	(6)
Jewellery	10.0	(7)	12.2	(7)

* in miles
** in minutes

Without application of the formula it is evident that distance and time sample means result in identical ordering. Under such conditions $d^2 = 0$, therefore

$$p = 1 - 0$$

$$= +1, \text{ a perfect positive correlation.}$$

Secondly, distance and time sample means are compared for last buy behaviour for which both types of data were collected. The absolute values, the ranks and the calculations involved are shown in Table 4.35.

In Table 4.35 there are a number of tied ranks and in each instance the item concerned is assigned the average of ranks which the tied observations occupy.

TABLE 4.35

LAKEHEAD: LAST BUY MEANS (DISTANCE AND TIME) COMPARISON

	Distance* $\bar{x}$	Time** $\bar{x}$	D-rank	T-rank	Difference d	d^2
Men's shoes	13.6	16.2	1	1	0	
Women's shoes	13.5	16.0	2	2	0	
Men's work clothes	12.7	15.2	3	3	0	
Lawyer	12.4	15.1	4.5	4.5	0	
Women's coat	12.4	15.1	4.5	4.5	0	
Men's coat	12.3	14.8	6	6	0	
Medical specialist	12.0	14.7	7	7	0	
Dentist	11.9	14.5	8	8	0	
Hospital	11.5	14.0	9	9	0	
Optometrist	11.3	13.9	10	10	0	
Family doctor	11.2	13.5	11	12.5	-1.5	2.25
Car insurance	11.1	13.7	12.5	11	+1.5	2.25
Bank	11.1	13.5	12.5	12.5	0	
Drugs	10.7	13.1	14	14.5	- .5	.25
Children's clothes	10.6	13.1	15	14.5	- .5	.25
Teenage girls' clothes	9.6	11.7	16	16	0	
Groceries	8.0	9.9	17	17	0	
Meat	7.9	9.8	18	18	0	

* in miles
** in minutes

$d^2 = 5.50$

The formula is

$$p = 1 - \frac{6 \sum d^2}{N (N^2 - 1)}$$

Substituting,

$$p = 1 - \frac{6 \times 5.50}{18 (18^2 - 1)}$$

$$= 1 - \frac{33}{5,814}$$

$$= 1 - .006$$

$$= + 0.994$$

The critical value of p with N = 18 is 0.399 at the 0.05 level, (and 0.564 at the 0.01 level); therefore, with a value of + 0.994 it may be asserted that there is a strong correlation between the distance and time sample means.

Thirdly, distance and time sample means, of the same items listed in Table 4.35, are compared for most buy behaviour. The absolute values are set out in Table 4.36, with ranks in parentheses.

TABLE 4.36

LAKEHEAD: MOST BUY MEANS (DISTANCE AND TIME) COMPARISON

	Distance*		Time**	
	$\bar{x}$	Rank	$\bar{x}$	Rank
Men's shoes	13.1	(1)	15.7	(1)
Lawyer	12.5	(2)	15.1	(2)
Women's coat	12.1	(3)	14.5	(3)
Women's shoes	12.0	(4)	14.4	(4)
Men's work clothes	11.8	(5)	14.3	(5.5)
Medical specialist	11.7	(6)	14.3	(5.5)
Optometrist	11.3	(8)	13.9	(7)
Men's clothes	11.3	(8)	13.8	(8)
Hospital	11.3	(8)	13.7	(10)
Car insurance	11.1	(11)	13.7	(10)
Dentist	11.1	(11)	13.7	(10)
Bank	11.1	(11)	13.6	(12)
Family doctor	11.0	(13)	13.4	(13)
Drugs	10.8	(14)	13.1	(14)
Children's clothes	10.1	(15)	12.5	(15)
Teenage girls' clothes	9.2	(16)	11.1	(16)
Groceries	8.3	(17)	10.3	(17)
Meat	8.1	(18)	10.0	(18)

*in miles
**in minutes

The result is, $p = + 0.992$, which is significant at the 0.05 level (and at the 0.01 level). Again, there is a high and significant positive correlation.

Thus the relationship between distance and time, based on a comparison of sample means, is very strong for both last buy data and for most buy data. Accordingly, it is reasonable to confine subsequent description and analysis to distance values.

In the preliminary perusal of the data on the spatial behaviour of consumers in Rainy River, there was an attempt to rank items, in terms of distance travelled by consumers, based on visual comparison of all of the desire line maps. Although this

preliminary item-ranking, on the basis of visual analysis, subsequently proved to correlate strongly ($p = + 0.87$) with the ranking ultimately adopted (rank-sum test), two features of the patterns of consumer movement at the Lakehead militate against ranking of items on a visual basis: firstly, there is such an apparent close correspondence amongst all of the spatial patterns that it is possible to identify only two items which are likely to involve lower distances than any others -- groceries and meat; and secondly, the necessity to employ two maps for each item hampers inter-item comparison. Accordingly, no ranking of items based on visual analysis is attempted for the Lakehead data.

A more precise way of ranking the Rainy River data was attempted by ranking of the array of items (Table 4.4) in accordance with sample mean distances; with the most buy mean, where both most buy and last buy means had been obtained, and on the last buy mean where only this had been obtained. This involved a mixing of two different types of value, most buy and last buy values, and the procedure was subsequently validated by comparing the total sets of observations for both types of mean, for the same item, in those cases of serious discrepancy between the two types of sample mean. It was discovered, in each case that there was no difference between the means of the respective parent populations.

For the Lakehead, it is proposed initially to rank the items on the basis of the sample distance means, utilising most buy means, where both most buy and last buy means are available, and last buy means where these are the only available summary measures. An estimate of the distortion this mixing is liable to introduce may be derived by comparing the overall relationships

of most buy means and last buy means, for those items for which both measures have been calculated. The absolute values, with ranks in parentheses, are set out in Table 4.37.

TABLE 4.37

LAKEHEAD: COMPARISON OF MOST AND LAST BUY DISTANCE MEANS*

	Most buy ($\bar{x}$)		Last buy ($\bar{x}$)	
Men's shoes	13.1	(1)	13.6	(1)
Lawyer	12.5	(2)	12.5	(4)
Women's coat	12.1	(3)	12.4	(5)
Women's shoes	12.0	(4)	13.5	(2)
Men's work clothes	11.8	(5)	12.7	(3)
Medical specialist	11.7	(6)	12.0	(7.5)
Optometrist	11.3	(8)	11.3	(10)
Men's coat	11.3	(8)	12.2	(6)
Hospital	11.3	(8)	11.5	(9)
Car insurance	11.1	(11)	11.1	(12.5)
Dentist	11.1	(11)	12.0	(7.5)
Bank	11.1	(11)	11.1	(12.5)
Family doctor	11.0	(13)	11.2	(11)
Drugs	10.8	(14)	10.7	(14)
Children's clothes	10.1	(15)	10.6	(15)
Teenage girls' clothes	9.2	(16)	9.6	(16)
Groceries	8.3	(17)	8.0	(17)
Meat	8.1	(18)	7.9	(18)

*in miles

$p = + 0.95$ at the 0.05 level.

p is corr. coeff.

With a relationship this strong, it is contended that it is reasonable to intermingle the most buy distance means of the items in Table 4.36 and the last buy means of the items in Table 4.34.

This intermingling has been effected in Table 4.38, where items are ranked on the basis of the sample means.

TABLE 4.38

LAKEHEAD: DISTANCE SAMPLE MEANS AND STANDARD ERRORS*

		$\bar{x}$	S.E.$\bar{x}$	S.E.$\bar{x}$ (.05)
1	Television	14.5	2.9	5.7
2	Car	14.1	1.5	2.9
3	Farm machinery	13.4	1.4	2.7
4	Men's shoes	13.1	1.6	3.1
5	Lawyer	12.5	0.9	1.8
6	Women's coat	12.1	1.3	2.6
7	Refrigerator	12.0	1.1	2.2
8	Women's shoes	12.0	1.3	2.5
9	Men's work clothes	11.8	1.3	2.5
10	Medical specialist	11.7	1.0	2.0
11	Watch	11.6	0.9	1.8
12	Optometrist	11.3	0.9	1.8
13	Furniture	11.3	0.8	1.6
14	Men's coat	11.3	0.8	1.6
15	Hospital	11.3	0.8	1.6
16	Car insurance	11.1	0.8	1.6
17	Dentist	11.1	0.8	1.6
18	Bank	11.1	0.8	1.6
19	Family doctor	11.0	0.8	1.6
20	Drugs	10.8	0.8	1.6
21	Children's clothes	10.1	1.0	2.0
22	Jewellery	10.0	0.9	1.8
23	Teenage girls' clothes	9.2	1.2	2.4
24	Groceries	8.3	0.6	1.2
25	Meat	8.1	0.6	1.2

*in miles

The range of the sample means is small, from 8.1 miles (meat) to 14.5 miles (television). Further, the individual sample means cover the whole of the range, ranked, as it were, on a continuum: there are no obvious breaks, but there is a strong suggestion of clustering, particularly in the range 11.0 - 11.8 miles. Eleven of the twenty-five sample values fall into this 0.8 mile range and four items out of the eleven have identical sample means; another three items also have identical sample means. The clustering tendency and identical values are highly

suggestive of either consumers varying the place of purchase by item and exhibiting an extreme sensitivity to distance or patronising the same settlements for several different items.

In the Rainy River data, however, the sample mean was shown to be a weak descriptor of the whole body of data from which the sample mean was drawn, because of extreme values and skew distributions of the observations about the sample mean. The sample standard deviations (s) and best estimates of the standard deviation ($\hat{\sigma}$) are set out in Appendix 12. Also listed there are the standard errors of the sample mean (S.E.$\bar{x}$), which are reproduced in Table 4.38; and the standard error to be applied in establishing the limits of the true mean ($\bar{X}$)at the 0.05 confidence level is given in the last column of Table 4.38.

The limits of the true means for all items in the array are depicted in Figure 4.29. The relationships exposed demonstrate that it would be possible for the true means of the items numbered 1-23 to coincide and it could then be asserted that these items constitute a group, with the remaining two items (groceries and meat) constituting another group.

Proof of this argument may be sought if it is decided that the sample means and standard deviations are sufficiently accurate descriptors of their sets of observations, for there are few extreme values. Inspection of these measures, set out in Appendix 12, suggests that the distributions are positively skewed but not as badly skewed as the Rainy River distributions. No tests for normalcy were performed and it was decided, in the interests of consistency, to apply the rank-sum test, since it is intended to compare the Rainy River and Lakehead findings.

The rank-sum test was applied to the first item in Table 4.38 pairing this item in turn with each item listed below it, in descending order; then the second item was considered along with, in turn, each item listed below it; and so on. The relevant hypotheses are

H_0: there is no difference between the means

H_1: the mean of the first item listed is greater than that of the second.

The procedure here was identical to that described for the Rainy River data. The Z-values derived from application of the rank-sum test were set out in matrix form, converted to the dichotomous score of 0 (acceptance of H_0) or 1 (rejection of H_0 and acceptance of H_1), and the items rearranged by a trial and error process so that item-ranking on a basis of frequency of exceeding other items' distances was achieved. This adjusted ranking of items is shown in Table 4.39.

A number of relationships can be discerned from Table 4.39. In terms of distance, each item is similar to at least one other item and usually to many more than one. Travel for farm machinery, for example, involves distances similar to those for car, lawyer and medical specialist, but dissimilar to another twenty-one items ranging from television to meat. Then there is a large break: travel distances for car involve dissimilarity to only six items, those for lawyer to only four. Seventeen items may be considered as a group, ranging from medical specialist to drugs: travel for these involves sets of similar distances, but each set is different from the sets involved in travel for

TABLE 4.39

LAKEHEAD: ADJUSTED RANKING OF ITEMS

	FM	Car	Law	MSp	TV	MS	WC	Ref	WS	MWC	Wa	Opt	Fur	MC	Hos	CI	Dent	Bank	FD	Dru	TGC	CC	Jew	Groc	Meat
FM	--	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Car		--	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
Law			--	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1
MSp				--	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
TV					--	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
MS						--	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
WC							--	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Ref								--	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
WS									--	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
MWC										--	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Wa											--	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Opt												--	0	0	0	0	0	0	0	0	0	0	0	1	1
Fur													--	0	0	0	0	0	0	0	0	0	0	1	1
MC														--	0	0	0	0	0	0	0	0	0	1	1
Hos															--	0	0	0	0	0	0	0	0	1	1
CI																--	0	0	0	0	0	0	0	1	1
Dent																	--	0	0	0	0	0	0	1	1
Bank																		--	0	0	0	0	0	1	1
FD																			--	0	0	0	0	1	1
Dru																				--	0	0	0	1	1
TGC																					--	0	0	0	0
CC																						--		0	0
Jew																							--	0	0
Groc																								--	0
Meat																									--

groceries and meat. The five remaining items, ranging from teenage girls' clothes to meat, constitute a group in that they all involve sets of similar travel distances, none of which exceed any other sets of travel distances.

It has earlier been observed that whereas the distance data yielded by information relating to last purchase and most purchase behaviour may not differ, it would still be possible for differences in settlement preference to exist between the two types of behaviour. The opportunity for discrepancies in settlement choices between the two types of behaviour is enhanced by the dispositions of Port Arthur and Fort William and by the strong similarities in the array of items each centre provides. It would be possible for a statistically significant proportion of the dispersed population to report one settlement preference, in connection with, for example, last buy, and to report another settlement preference in connection with most buy, without any statistically significant differences in the sets of travel distances.

Cost factors prevented testing each pair of sets of distance data, for the eighteen items for which they are available. Indeed, as Table 4.40 shows, in some cases the sample means are so close to each other that a complete set of tests is probably unwarranted.

The pairs of means of five items have been selected for comparison: women's shoes, with the largest discrepancy of 1.5 miles, men's work clothes, with a discrepancy of 1.1 miles, dentist and men's coat, a service and a good, each with a discrepancy of 0.9 miles, and men's shoes, with a small discrepancy of 0.5 miles. In each of these five cases the last buy sample

TABLE 4.40

LAKEHEAD: LAST & MOST BUY SAMPLE MEANS*

	Most buy $\bar{x}$	Last buy $\bar{x}$	d**
Lawyer	12.5	12.5	0
Medical specialist	11.7	12.0	0.5
Men's shoes	13.1	13.6	0.5
Women's coat	12.1	12.4	0.3
Women's shoes	12.0	13.5	1.5
Men's work clothes	11.8	12.7	1.1
Optometrist	11.3	11.3	0
Men's coat	11.3	12.2	0.9
Hospital	11.3	11.5	0.2
Car insurance	11.1	11.1	0
Dentist	11.1	12.0	0.9
Bank	11.1	11.1	0
Family doctor	11.0	11.2	0.2
Drugs	10.8	10.7	0.1
Teenage girls' clothes	9.2	9.6	0.4
Children's clothes	10.1	10.6	0.5
Groceries	8.3	8.0	0.3
Meat	8.1	7.9	0.2

* miles
** d = difference

mean is greater than the most buy sample mean. Accordingly, the rank-sum test has been applied in terms of a directional hypothesis:

H_0: there is no difference between the last buy and most buy true means

H_1: the last buy true mean is greater than the most buy true mean.

The results of running the test on each pair of distance data-sets are set forth in Table 4.41.

TABLE 4.41

LAKEHEAD: COMPARISON OF LAST & MOST BUY DISTANCE MEANS

	Z-value	Critical Value (at 0.05 sig.)
Women's shoes	0.36	1.56
Men's work clothes	0.27	1.56
Dentist	0.02	1.56
Men's coat	0.10	1.56
Men's shoes	0.07	1.56

No Z-value is as large as the critical value of 1.56, therefore the null hypothesis of no statistically significant difference between last buy and most buy true means is accepted.

With no statistically significant differences between most buy and last buy mean distances, it is to be expected that no statistically significant differences will occur in settlement preference between most buy and last buy behaviour. Given the close juxtaposition of the two Lakehead cities of Port Arthur and Fort William, however, it is possible that a variation in settlement preference between most buy and last buy behaviour could exist without being revealed in distance difference. Therefore, the settlement preference sample frequency distributions for both types of behaviour in respect of selected items have been compared by means of the chi-square test. The sample frequency distributions are set out in Appendix 13 and visual inspection reveals numerical discrepancies, between both types of behaviour, so low that performance of the chi-square test for each of the eighteen pairs of

frequency distribution is unwarranted. Differences between last buy and most buy preference for each settlement are generally of the order of three to five and nowhere does the difference exceed ten. With df = 2 the critical chi-square value is 5.99; and the chi-square values of those items selected (lawyer, $X^2 = 1.03$; women's shoes, $X^2 = 0.55$; men's work clothes, $X^2 = 0.61$; dentist, $X^2 = 3.09$; and children's clothes, $X^2 = 1.99$) do not attain this level. On the basis of these values for selected items, it is argued that no statistically significant differences exist between the most buy and last buy distributions of settlement preferences for each of the eighteen items.

En passant, attention is directed to discrepancies between the total number of observations for the two types of data in respect of several items. In sixteen out of the eighteen pairs of items, the total number of responses for last buy is lower than that for most buy; in two cases only (groceries and meat) is the condition reversed; and in one case only (bank) the totals are equal. The values for last buy and most buy by catalogue (or post) are given in Appendix 13. Consumption by catalogue, or post, is not feasible in some cases -- for example optometrist, where face-to-face contact between client and practitioner is demanded -- and, whereas the values for consumption via catalogue are usually slightly higher in the case of last buy than in the case of most buy, they are not high enough to equalise the last buy-most buy discrepancy. Generally, some last buy behaviour reported and recorded fell outside the scope of this study, the item being consumed when the respondent was either on vacation or on a business trip. Such responses were deleted and not considered in the results. In the cases of meat

and grocery, no explanation can be suggested for the grocery discrepancy; but the meat discrepancy may be attributed to a tendency to consume meat produced on farms, for which no place of purchase could be reported, with the last instance of behaviour, in five cases involving purchase perhaps occasioned by the desire for prepared or treated meat.

Further inspection of the values contained in Appendix 13, including those for the seven items for which last buy behaviour was recorded, suggests that Port Arthur and Fort William dominate in the provision of all items except groceries and meat and, further, that there is a degree of fluctuation amongst the items in the preferences for either Port Arthur and Fort William. It is shown earlier (Chapter 3) that the overall status of Port Arthur and Fort William as service-centres is very close, but there is still the possibility of the one being preferred over the other in respect of individual items. Resolution of the issue is provided by considering only the Port Arthur and Fort William values and applying a form of the chi-square test.

The reduced distribution for car purchase serves as an example:

H_0: There is no preference for the settlement with the higher of the two sample values.

H_1: There is a preference for this settlement.

Observed Values

Item	PA	FW	Total
Car	116	52	168

Expected Values

Item	PA	FW	Total
Car	84	84	168

$$X^2 = \sum \frac{(O - E)^2}{E} = \frac{(116 - 84)^2}{84} + \frac{(52 - 84)^2}{84}$$

$$= 12.19 + 12.19$$

$$= 24.38$$

The critical value at 0.05 with df = 1, = 2.71; therefore H_0 is rejected and H_1 is accepted. The results of applying this form of the chi-square test are set forth in Table 4.42. In the cases of only three of the twenty-five items is there a statistically significant preference for one service centre over the other and in all three cases a greater preference is shown for Port Arthur. This suggests that these three items should be considered in more detail, in subsequent analysis, on the ground of distinct and intrinsic settlement preference.

Another ground for detailed consideration of certain items can be suggested: travel distance variation. Reference to Table 4.42 suggests that farm machinery, car and lawyer each deserve more detailed examination; and that at least one item from each of the groups bounded by medical specialist and drugs and by teenage girls' clothes and meat should be selected.

The results contained in Table 4.42 suggest that there is additional weight for examining consumer behaviour in respect of cars in more detail and that perhaps consumer behaviour in respect of refrigerator and furniture should be examined. Thus,

the results contained in Table 4.39 would aid in selection from within the medical specialist-drug group. Prior tests, however, should be applied to the Lakehead frequency distributions, with the aim of identifying additional items in need of closer scrutiny.

The form of the chi-square test applied to the Lakehead frequency distributions, to show intrinsic settlement choice, differs from the form applied in the Rainy River frequency distributions. In the case of the Rainy River data, pairs of distributions were compared, and considerable difficulty was encountered as the array of centres varied with the item, thus preventing a straightforward comparison of all frequency distributions.

The frequency distributions into which the Lakehead data have been arranged, however, are standardised inasmuch as the same three classes are used for each item: Port Arthur, Fort William and Other. Were it not for some very low values occurring under the "other" designation and producing expected values below 2, it would be possible validly to compare all frequency distributions. As a first step this comparison was attempted and the frequency distributions were compared with each other according to the sequence of items established in Table 4.39. The computer programme employed generated the expected values for each chi-square test and the value of X^2.

Where any one or more of the six expected values fell below 2 no value of X^2 was entered in Table 4.43, where the valid values are set out in matrix form. The cells with no values entered do not occur haphazardly over the matrix, rather they are associated with certain items: lawyer, watch, optometrist, teenage girls' clothes and children's clothes. There are two

TABLE 4.42

LAKEHEAD: PORT ARTHUR-FORT WILLIAM CHOICE

	X^2 value
Farm machinery	3.12
Car	24.38*
Lawyer	0.78
Medical specialist	0.48
Television	1.42
Men's shoes	0.00
Women's clothes	0.04
Refrigerator	3.92*
Women's shoes	0.66
Men's work clothes	0.88
Watch	0.32
Optometrist	0.04
Furniture	4.16*
Men's coat	0.02
Hospital	0.61
Car insurance	0.20
Dentist	2.04
Bank	0.41
Family doctor	0.92
Drugs	1.56
Teenage girls' clothes	0.08
Children's clothes	0.02
Jewellery	0.00
Groceries	0.66
Meat	0.21

* Significant difference; df = 1, at 0.05 level; critical value is 2.71.

main situations causing this condition: where a pair of sample distributions have strongly similar observed proportions in the Port Arthur and Fort William cells and a very low score in both of the "other" cells; or where there is a degree of dissimilarity between the proportions in the Port Arthur and Fort William cells of both sample distributions and it is not great enough to generate a high enough expected frequency even when one of the pair of "other" observations is dissimilar to the corresponding "other" observation.

An extreme example of the first situation is provided by a comparison of the optometrist and watch sample frequency distributions:

Observed Frequencies

Item	PA	FW	O	TOTAL
Optometrist	75 (49)	78 (31)	0 (0)	153 (100)
Watch	79 (52)	72 (48)	0 (0)	151 (100)

Expected Frequencies

Item	PA	FW	O
Optometrist	77.5	75.5	0
Watch	76.5	74.5	0

An example of the second situation is provided by a comparison of car and lawyer frequency distributions:

Observed Frequencies

Item	PA	FW	O	TOTAL
Car	116	52	3	171
Lawyer	71	82	0	153

Expected Frequencies

Item	PA	FW	O
Car	98.7	70.7	1.6
Lawyer	88.3	63.3	1.4

The valid chi-square values resulting from comparisons of pairs of three-cell frequency distribution are set out in Table 4.43, which may be simplified by replacing X^2 value of 5.98 and lower with

TABLE 4.43

LAKEHEAD: CHI-SQUARE VALUES FOR 3-CELL DISTRIBUTION

	FM	Car	Law	MSp	TV	MS	WC	Ref	WS	MWC	Wa	Opt	Fur	MC	Hos	CI	Dent	Bank	FD	Dru	TGC	CC	Jew	Groc	Meat
FM	--	28.39	39.37	24.48	9.91	32.71	31.63	14.23	30.59	29.33	36.91	38.38	29.52	40.16	34.39	30.99	36.49	37.51	22.26	29.01	8.57	25.51	25.35	3.86	3.19
Car		--		15.01	13.63	12.79	14.02	7.63	17.48	14.59	12.05		4.73		19.15	10.79	21.11	16.95	20.11	20.37			11.47	45.59	46.77
Law			--		14.36			12.54											6.56	4.16				33.97	37.40
MSp				--	6.21	0.49	0.25	5.37	0.00	0.11			3.60			0.79	0.74	0.69	0.94	0.14			0.34	22.23	25.06
TV					--	8.21	8.09	1.03	7.89	6.83	12.22	13.22	7.33	12.62	10.18	7.42	12.23	11.32	4.30	7.64	0.91	7.45	6.47	12.91	14.79
MS						--	0.04	5.74	0.55	0.23			1.99	1.00	0.70	0.07	1.33	0.47	2.74	1.37				32.59	36.12
WC							--	6.02	0.27	0.12			2.58	1.07	0.37	0.23	0.93	0.34	2.25	0.92			0.01	30.81	34.29
Ref								--	6.55	5.15	9.28	10.88	3.48	9.72	8.63	4.79	10.80	9.04	4.70	7.02	0.65	5.98	4.91	20.22	22.17
WS									--	0.13			4.23	2.01	0.19	0.91	0.78	0.71	1.25	0.19			0.36	29.45	33.13
MWC										--			2.89	1.85	0.48	0.41	1.27	0.79	1.39	0.53	0.65	0.72	0.18	29.04	32.52
Wa											--								7.62	5.68				34.52	37.47
Opt												--							6.78	4.58				34.13	37.38
Fur													--	3.51	5.00	1.27	6.25	3.96	6.54	5.87	1.45	2.36	1.95	34.55	37.23
MC														--	1.43	1.23			5.60	3.21				37.40	41.11
Hos															--	1.21	0.21	0.31	2.21	0.50			0.41	32.18	36.05
CI																--	1.99	0.86	3.01	1.86			0.13	31.63	34.91
Dent																	--		3.32	1.12				32.83	36.67
Bank																		--	3.61	1.47				35.09	38.94
FD																			--	0.71	0.48	2.89	2.07	21.92	25.36
Dru																				--				27.70	31.46
TGC																					--			7.62	8.55
CC																						--		22.90	25.31
Jew																							--	23.70	26.32
Groc																								--	0.20
Meat																									--

TABLE 4.44

LAKEHEAD: CONVERSION OF CHI-SQUARE VALUES FOR 3-CELL DISTRIBUTION

	1 FM	2 Car	3 Law	4 MSp	5 TV	6 MS	7 WC	8 Ref	9 WS	10 MWC	11 Wa	12 Opt	13 Fur	14 MC	15 Hos	16 CI	17 Dent	18 Bank	19 FD	20 Dru	21 TGC	22 CC	23 Jew	24 Groc	25 Meat
1 FM	--	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0
2 Car		--		1	1	1	1	1	1	1			0		1	1	1	1	1	1			1	1	1
3 Law			--		1			1											1	0				1	1
4 MSp				--	1	0	0	0	0	0			0		0	0	0	0	0	0	0		0	1	1
5 TV					--	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1
6 MS						--	0	0	0	0			0	0	0	0	0	0	0	0			0	1	1
7 WC							--	1	0	0			0	0	0	0	0	0	0	0			0	1	1
8 Ref								--	1	0	1	1	0	1	1	0	1	1	0	1	0	0	0	1	1
9 WS									--	0			0	0	0	0	0	0	0	0			0	1	1
10 MWC										—			0	0	0	0	0	0	0	0			0	1	1
11 Wa											--								1	0				1	1
12 Opt												--							1	0				1	1
13 Fur													--	0	0	0	1	0	1	0			0	1	1
14 MC														—	0	0			0	0				1	1
15 Hos															--	0	0	0	0	0			0	1	1
16 CI																--	0	0	0	0			0	1	1
17 Dent																	--	0	0	0				1	1
18 Bank																		—	0	0				1	1
19 FD																			—	0	0	0	0	1	1
20 Dru																				—				1	1
21 TGC																					--			1	1
22 CC																						--		1	1
23 Jew																							--	1	1
24 Groc																								--	0
25 Meat																									--

the score 0 (no difference) and the X^2 value of 5.99 and higher with the score 1 (a difference). The results of this dichotomous scoring process are set out in Table 4.44 where, even with empty cells, a degree of patterning may be observed.

(i) Farm machinery differs from all items, other than groceries and meat, and the sources of the difference probably stem from the greater proportion of the sample visiting Port Arthur in preference to Fort William and using "other" settlements. Noticeably a high proportion of consumers utilise "other" settlements for purchase of groceries, meat and farm machinery.

(ii) Car differs from all other items for which values were obtained, except furniture. It may be recalled that both car and furniture exhibited an intrinsic tendency for Port Arthur to be preferred to Fort William (Table 4.42).

(iii) Television differs from all other items, except for refrigerator, in the purchase of which consumers demonstrated an intrinsic preference for Port Arthur; and except for teenage girls' clothes, which show no tendency to be purchased outside of either Port Arthur and Fort William and thus contrast with television's fairly high proportion of extra-twin city sales.

(iv) Consumers demonstrate an intrinsic preference to visit Port Arthur for refrigerator purchases (Table 4.42) and this behaviour contrasts with those items for which the sample of consumers demonstrate a tendency to prefer Fort William over Port Arthur but insufficiently to create an intrinsic preference. Where one sample with a preference to visit one centre is compared to another sample with a preference to visit another centre, the opposing trends are often sufficient to create statistically

significant differences where none exist intrinsically in either or both of the sample distributions considered singly.

(v) The distributions of consumer settlement choices in respect of groceries and meat, while similar to each other, both differ from all other items except that of farm machinery; the source of the similarities and differences residing in the high proportion of visits for purchase of groceries and meat to settlements other than Port Arthur and Fort William.

This apparent patterning of consumer behaviour stems from similarities and differences in the use of either Port Arthur or Fort William and the use of "other" settlements; and it is difficult precisely to identify which of the two is operational. The matter of choice for a single item between Port Arthur and Fort William was clarified by applying the chi-square test individually to the Port Arthur and Fort William figures and excluding the visits to other settlements. It is possible also to apply the chi-square test to pairs of distributions composed of only the trips to Port Arthur and Fort William and excluding the trips to other settlements. The X^2 values have been entered in matrix-form in Table 4.45 and, with df = 1 at the 0.05 level and a critical value of 3.84, Table 4.45 has been simplified, by a process of dichotomous scoring, to Table 4.46. Comparison between Tables 4.44 and 4.46 is difficult because of the necessary omissions in Table 4.44; but the effect of concentration on the intercity preferences appears to be a reduction in the number of differences recorded: farm machinery, 22 in Table 4.44, six in Table 4.46; lawyer, four differences recorded in Table 4.44 are not recorded in Table 4.46; and all other differences recorded in Table 4.44 do not appear in Table 4.46,

TABLE 4.45

LAKEHEAD: CHI-SQUARE VALUES FOR 2-CELL DISTRIBUTION

	FM	Car	Law	MSp	TV	MS	WC	Ref	WS	MWC	Wa	Opt	Fur	MC	Hos	CI	Dent	Bank	FD	Dru	TGC	CC	Jew	Groc	Meat
FM	--	0.59	3.91	3.52	0.98	2.40	2.82	0.39	3.79	2.93	1.63	2.78	0.42	2.71	4.32	1.88	4.99	3.52	4.04	4.60	1.15	2.54	2.44	3.77	3.19
Car		--	16.88	14.93	7.02	12.78	14.02	4.41	17.40	14.50	9.36	13.32	4.73	13.85	19.14	10.78	20.89	16.65	18.28	20.02	4.74	11.23	11.45	16.34	14.15
Law			--	0.00	2.17	0.49	0.24	4.10	0.01	0.20	1.06	0.20	4.18	0.30	0.00	0.91	0.11	0.04	0.00	0.03	0.47	0.18	0.28	0.00	0.05
MSp				--	1.74	0.33	0.14	3.43	0.00	0.11	0.80	0.11	3.48	0.18	0.03	0.67	0.18	0.01	0.00	0.08	0.36	0.11	0.18	0.00	0.01
TV					--	0.68	1.05	0.30	2.05	1.16	0.18	1.02	0.29	0.95	2.66	0.31	3.47	1.76	2.34	3.00	0.10	0.84	0.75	2.01	1.42
MS						--	0.04	1.97	0.39	0.07	0.13	0.05	1.99	0.02	0.70	0.07	1.18	0.26	0.53	0.88	0.04	0.03	0.01	0.42	0.18
WC							--	2.54	0.16	0.00	0.32	0.00	2.58	0.00	0.37	0.23	0.75	0.08	0.26	0.51	0.13	0.00	0.00	0.19	0.05
Ref								--	4.02	2.72	0.96	2.45	0.00	2.41	4.87	1.27	5.91	3.63	4.43	5.32	0.50	2.02	1.93	3.87	2.98
WS									--	0.13	0.94	0.14	4.12	0.22	0.04	0.80	0.21	0.01	0.00	0.09	0.39	0.12	0.20	0.00	0.02
MWC										--	0.38	0.00	2.76	0.01	0.32	0.28	0.67	0.06	0.21	0.44	0.15	0.00	0.01	0.15	0.03
Wa											--	0.33	0.95	0.27	1.36	0.01	1.96	0.75	1.14	1.60	0.00	0.26	0.20	0.96	0.58
Opt												--	2.48	0.00	0.32	0.23	0.66	0.07	0.22	0.44	0.13	0.00	0.00	0.16	0.04
Fur													--	2.44	4.99	1.27	6.07	3.71	4.54	5.46	0.48	2.03	1.94	3.95	3.03
MC														--	0.46	0.18	0.86	0.13	0.32	0.61	0.10	0.00	0.00	0.25	0.08
Hos															--	1.20	0.06	0.10	0.01	0.01	0.58	0.28	0.41	0.01	0.11
CI																--	1.80	0.61	0.99	1.44	0.00	0.18	0.12	0.82	0.46
Dent																	--	0.33	0.13	0.02	0.86	0.57	0.76	0.15	0.34
Bank																		--	0.04	0.18	0.31	0.06	0.12	0.02	0.00
FD																			--	0.04	0.48	0.19	0.29	0.00	0.06
Dru																				--	0.69	0.39	0.54	0.05	0.19
TGC																					--	0.11	0.08	0.42	0.25
CC																						--	0.00	0.15	0.04
Jew																							--	0.23	0.08
Groc																								--	0.03
Meat																									

TABLE 4.46

LAKEHEAD: CONVERSION OF CHI-SQUARE VALUES FOR 2-CELL DISTRIBUTIONS

	1 FM	2 Car	3 Law	4 MSp	5 TV	6 MS	7 WC	8 Ref	9 WS	10 MWC	11 Wa	12 Opt	13 Fur	14 MC	15 Hos	16 CI	17 Dent	18 Bank	19 FD	20 Dru	21 TGC	22 CC	23 Jew	24 Groc	25 Meat
1 FM	--	0	1	1	0	0	0	0	0	0	0	0	0	0	1	0	1	0	1	1	0	0	0	0	0
2 Car		--	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
3 Law			—	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
4 MSp				--	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5 TV					--	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6 MS						--	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7 WC							—	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8 Ref								—	1	0	0	0	0	0	1	0	1	0	1	1	0	0	0	1	0
9 WS									—	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
10 MWC										—	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11 Wa											—	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12 Opt												--	0	0	0	0	0	0	0	0	0	0	0	0	0
13 Fur													--	0	1	0	1	0	1	1	0	0	0	1	0
14 MC														--	0	0	0	0	0	0	0	0	0	0	0
15 Hos															--	0	0	0	0	0	0	0	0	0	0
16 CI																--	0	0	0	0	0	0	0	0	0
17 Dent																	--	0	0	0	0	0	0	0	0
18 Bank																		--	0	0	0	0	0	0	0
19 FD																			—	0	0	0	0	0	0
20 Dru																				—	0	0	0	0	0
21 TGC																					--	0	0	0	0
22 CC																						—	0	0	0
23 Jew																							--	0	0
24 Groc																								--	0
25 Meat																									--

except in the cases of women's shoes, refrigerator and furniture.

To determine which of Port Arthur or Fort William consumers prefer to visit for a particular item in contrast to another item, Table 4.46 must be read in conjunction with the frequency distributions in Appendix 13. Using the information contained in this appendix Table 4.46 has been amplified to show apparent direction of difference in settlement choice (Table 4.47). This table should be read laterally only and is interpreted thus: the dispersed consumers prefer to visit Port Arthur for farm machinery and Fort William for lawyer's services, specialist medical services, hospital services, the services of dentist and doctor and the purchase of drugs. In other words, a P recorded against one of the vertically-listed items denotes a consumer preference for Port Arthur as compared to a consumer preference for Fort William in respect of the horizontally-listed item; and vice-versa.

There are, however, some difficulties associated with this interpretation and these difficulties stem from the comparison of car and seven other items -- those with other cells marked by an asterisk (*). In the cases of these seven items, the sample of consumers tends to prefer Port Arthur to Fort William; but not enough, except in the cases of refrigerator and furniture, to allow assertion of an intrinsic preference. The sample frequency distribution for car also shows a preference for Port Arthur, in this case an intrinsic preference. Yet the results of comparing car with these seven items (all eight items have a sample tendency to prefer Port Arthur) indicate a difference between the car distribution and the other seven. Two interpretations seem possible.

Either the car distribution is different from all other distributions to such an extent that it is significantly different from even distributions which tend in the same direction -- in which case the P designations assigned to farm machinery and the F designations assigned to lawyer and women's shoes are valid; or the designations of comparative preference -- for example whereas consumers prefer Port Arthur for refrigerator purchases they prefer For William for lawyer's services -- is valid only when at least one of the pairs of frequency distributions have been proved to demonstrate an intrinsic preference for one centre.

The second interpretation would result in the tendency identified for consumers to prefer Port Arthur for farm machinery and Fort William for the services of a lawyer being declared invalid; and for all other designations assigned to farm machinery, as well as all those assigned to lawyer and women's shoes, being declared invalid.

Since the analyses of distance depended upon inter-item comparison, it is argued that inter-item differences in frequency distributions are significant even in cases where neither consumer sample demonstrates an intrinsically significant preference for a particular settlement; and, in addition, the comparison of two sample distributions tending in the same direction, is invalid in terms of the context of this test. Accordingly, the first of the two interpretations of the anomalous results is accepted.

A pattern is apparent from the results listed in Table 4.47: apart from the consumers' preference to visit Fort William for purchases of women's shoes, there is a tendency for consumers to prefer to visit Port Arthur for purchases of certain goods,

TABLE 4.47

LAKEHEAD: COMPARATIVE SETTLEMENT CHOICE

		1 FM	2 Car	3 Law	4 MSp	5 TV	6 MS	7 WC	8 Ref	9 WS	10 MWC	11 Wa	12 Opt	13 Fur	14 MC	15 Hos	16 CI	17 Dent	18 Bank	19 FD	20 Dru	21 TGC	22 CC	23 Jew	24 Groc	25 Meat
1	FM	--		P	P	·										P		P		P	P					
2	Car		--	P	P	*	*	P	*	P	P	*	P	*	P	P	*		P	P	P	*	P	P	P	P
3	Law			—					F					F												
4	MSp				--																					
5	TV					--																				
6	MS						--																			
7	WC							--																		
8	Ref			P					—	P						P		P		P	P					P
9	WS									--				F												
10	MWC										—															
11	Wa											--														
12	Opt												--													
13	Fur													—		P		P		P	P					P
14	MC														--											
15	Hos															--										
16	CI																--									
17	Dent																	--								
18	Bank																		--							
19	FD																			--						
20	Dru																				--					
21	TGC																					--				
22	CC																						--			
23	Jew																							--		
24	Groc																								--	
25	Meat																									--

compared to a preference to visit Fort William to obtain certain services.

It was earlier decided, on grounds of distance difference, that consumer behaviour in respect of farm machinery, car and lawyer should be examined in greater detail. There remained the problem of choice within the two groups medical specialist-drugs and teenage girls' clothes-meat. In respect of the first group more detailed examination of consumer behaviour in respect of either refrigerator or furniture, but not both, is required; and for control purposes consumer behaviour in respect of some other item with no intrinsic settlement preference nor a comparative settlement preference -- items 5-7, 10-14, 16 and 18. A random selection between refrigerator and furniture produced furniture; and a random selection from the array of remaining items produced item number 5 -- television. With reference to the second group, more detailed examination of consumer behaviour in respect of either groceries or meat, but not both, is required because of the travel distances and the dissimilarity of their frequency distributions to all others except that of farm machinery. Random selection from groceries and meat produced groceries. The control item could be any one of items 21-24 and a process of random selection produced jewellery.

Thus the items selected for more detailed examination of consumer behaviour are: (1) farm machinery, (2) car, (3) lawyer, (5) television, (8) refrigerator, (23) jewellery and (24) groceries.

In each detailed examination of an item there are three main types of information: the sample values for settlement preference; desire line maps prepared from the questionnaire; and distrance data, calculated on the basis of the questionnaire

information and the desire line maps. The desire line maps require further comment. It proved impossible to retain clarity when the desire lines between all respondent locations and place of item purchase were drawn in at a scale of 1:250,000, due principally to the large number of respondents in the townships of Neebing and McIntyre, both of which are contiguous with the urban areas and both of which have become heavily suburbanised. For presentation here the maps prepared at 1:250,000 have been substantially reduced and inclusion of Neebing and McIntyre desire lines would have completely obscured any relationships. Therefore, the desire lines for each item are shown on two maps: those desire lines emanating from all the dispersed sample other than in Neebing and McIntyre are shown in the first map, labelled a; and those emanating from the dispersed sample in Neebing and McIntyre are shown in the second, labelled b. It is realised that this procedure is cumbersome and that it involves considerable effort, particularly in scale adjustment, when items are being compared; but the alternative of including all desire lines on the one map would have allowed little comparison, if any, of value.

Spatial Behaviour of Consumers

(1) Farm Machinery

Settlement preferences in purchases of farm machinery are summarised in Table 4.48, (values in parentheses are percentages) and details of the actual consumer movement are shown in Figure 4.30 (a and b).

TABLE 4.48

LAKEHEAD: FARM MACHINERY SETTLEMENT CHOICE

PA	FW	O	TOTAL
29 (49)	17 (29)	13 (22)	59 (100)

This item is ranked third in terms of sample mean distance (Table 4.38) and ranked first in terms of the number of item-means its own mean distance exceeds (Table 4.39). The writer has shown elsewhere (Davies, 1968a and 1968b) that farms in part of the Lakehead area encompassed by this study are highly mechanised, partly due to the compression of farm activities into a short summer period and partly due to a severe lack of skilled labour available for permanent or temporary hire. If this finding is applicable to this wider study area, it may be argued that a high degree of accessibility between farms and sales/service points is to be expected, since breakdown of machinery in the short operations period would be critical to the financial success of farming enterprises, most of which are marginally successful in any case. It is surprising, then, to discover the large distances involved, compared with other items.

The comparatively high distances themselves may be partially accounted for by the distribution of the respondents to whom the item is applicable, compared to the distribution of the respondents to whom the other items are applicable. The townships of Neebing and McIntyre are experiencing, and have experienced for over twenty years, increasing suburbanisation, as residents of

Port Arthur and Fort William purchase farm lots there and subdivide them or otherwise allow the agricultural function to deteriorate and cease. This trend means that a higher proportion of the respondents to whom this item is applicable live further away from Port Arthur and Fort William than is the case in respect of other items. This distributional characteristic, which seems to be substantiated by a comparison of Figure 4.30 with Figure 4.32, is not wholly satisfactory as an explanation, because there are three points in the outlying area which provide farm machinery: Murillo, Rosslyn and Kakabeka Falls. Indeed, farm machinery stands out from all other items, except meat and groceries, in the high proportion of all respondents visiting service points other than Port Arthur and Fort William. Examination of the actual lines of movement (Figure 4.30, a and b) reveals that many of those consumers utilising the "other" settlements incur greater travel-distances than if they utilised either Port Arthur or Fort William, particularly so in the case of McIntyre residents travelling to Murillo.

One last explanation may be tentatively forwarded. Port Arthur attracts more consumers than Fort William; not enough for it to be asserted that there is a distinct intrinsic preference for Port Arthur, but possibly enough to affect the distance consideration.

Thus the distributional characteristics of the respondents, the slight tendency of respondents to undertake journeys longer than necessary and the greater utilisation of Port Arthur, over Fort William, combine to produce a high sample mean travel distance and to produce a mean travel distance ranked first on the basis of the number of other mean travel distances it exceeds.

The mean travel distance for farm machinery is similar to the mean travel distance for car (Table 4.39). Since the distributional characteristics of respondents demanding cars may be expected to approximate the distributional characteristics of most other items -- particularly in respect of a stronger demand component from Neebing and McIntyre -- the lack of distance difference may seem surprising.

(2) Car

The settlement preferences for car are set out in Table 4.49 and Figure 4.31 details patterns of movement.

TABLE 4.49

LAKEHEAD: CAR SETTLEMENT CHOICE

Item	PA	FW	O	TOTAL
Car	116 (68)	52 (30)	3 (2)	171 (100)

Comparison of the actual values involved in farm machinery and car settlement preferences by the chi-square test yields a value of $X^2 = 28.39$ (at 0.05 with df 2). With the critical value of 5.99 exceeded, it may be asserted that there is a difference between the two sets of settlement preferences. This is little difference between farm machinery and car in the percentages travelling to Fort William (29% and 30% respectively). However, *circa* twenty per cent of the respondents purchase farm machinery in "other" settlements . Only two per cent of respondents purchase cars in "other" settlements and the percentage purchasing

cars in Port Arthur is nearly twenty per cent higher than the farm machinery percentage. (For the sake of clarity, it should be noted that it is not argued that those respondents who purchase farm machinery in "other" settlements purchase cars in Port Arthur).

It may be suggested, then, that whereas the settlement preferences are different, they are not sufficiently different to cause a distance difference.

It is noted earlier that respondents show a distinct preference for Port Arthur for car purchases. In part this stems from the location within Port Arthur of a disproportionate number of establishments of the car sales type. Establishments offering cars for sale generally require extensive tracts of land for display of a large array of models. Thus car sales are rarely a central business district function. Thirteen car dealers are located in Port Arthur and six in Fort William; moreover four car dealers, selling the most popular models, are located in the Inter-City area on Inter-City Road, a central location between the built-up areas of Port Arthur and Fort William, but an area which lies within the Port Arthur Municipal boundary. It is this statistically significant consumer preference for Port Arthur which is held responsible for the higher distances travelled and car being ranked second in Table 4.39.

(3) Lawyer

The distribution of settlement choices shown by the rural consumers in satisfying their demands for the services of a lawyer is shown in Table 4.50, and the spatial expression of this behaviour is shown in Figure 4.32 (a and b).

TABLE 4.50

LAKEHEAD: LAWYER SETTLEMENT CHOICE

Item	PA	FW	O	TOTAL
	71	82	0	153
	(46)	(54)	(0)	(100)

The slight tendency of consumers to visit Fort William rather than Port Arthur, indicated by the sample values in Table 4.50, is not high enough for assertion of intrinsic preference (Table 4.42); but it is probably high enough to affect comparative distance relationships, especially when all travel is to either of the two cities and especially when the desire line maps suggest a slight tendency for consumers in the north of the study area to bypass Port Arthur and involve themselves in the longer trip to Fort William.

(5) Television

The distribution of consumers' settlement choices is shown in Table 4.51, and details of the patterns of movement are shown in Figure 4.33 (a and b).

TABLE 4.51

LAKEHEAD: TELEVISION SETTLEMENT CHOICE

PA	FW	O	TOTAL
86	71	13	170
(51)	(42)	(7)	(100)

In terms of the relationships detailed in Tables 4.39 and 4.45, consumer behaviour in respect of this item may be taken as representative of the medical specialist-drugs group, inasmuch as there is no tendency to utilise either of Port Arthur or Fort William in preference to the other. In terms of the relationships detailed in Table 4.44, consumer behaviour is more akin to that for refrigerator -- and furniture -- to the extent that the seven per cent use of "other" settlements is quite high for this group of items, but it is not high enough to produce distance differences.

In Figure 4.33 (a) there is considerable overlap in the Port Arthur and Fort William service areas, except to the south-west of Fort William and to the north-west of Port Arthur. A little surprising, perhaps, is the movement from the area to the north of Nolalu to Port Arthur.

Kakabeka Falls has developed a small service area, but not necessarily based upon movement from points close to it. In fact, consumers closer to Kakabeka Falls than those reporting purchases there bypass Kakabeka Falls and travel to Port Arthur and Fort William. It is thought that purchases at Kakabeka Falls are based on factors other than those operating in Fort William or Port Arthur: for example, personal relationships. Nolalu has no specific establishment dealing in televisions: either the respondents erred or reconditioned machines were purchased.

From Figure 4.33b it appears that the Port Arthur service area is wider than that of Fort William but this feature is a function, in part, of the size-disparity between McIntyre Township, which is larger, and Neebing Township.

(8) Regrigerator

The distribution of consumer trips is set out in Table 4.52, and the spatial pattern of these trips detailed in Figure 4.34 (a and b).

TABLE 4.52

LAKEHEAD: REFRIGERATOR SETTLEMENT CHOICE

PA	FW	O	TOTAL
92 (55)	67 (40)	9 (5)	168 (100)

There is an intrinsic preference for Port Arthur on the part of consumers but it is difficult to identify this feature from the figure. It is difficult to explain why consumers should prefer to purchase refrigerators in Port Arthur as opposed to Fort William, unless perhaps it is the existence of Simpsons-Sears department store at Inter-City Plaza which causes the preference, because the Inter-City Plaza is actually located within the Port Arthur municipal boundary.

(23) Jewellery

Compared to most of the other items in the full array, the number of consumers purchasing jewellery is low. The mean distance is low (Table 4.38 and 4.39), as is the number of consumers patronising "other" settlements; and the sample indicates almost no preference for either Port Arthur or Fort William (Table 4.53).

TABLE 4.53

LAKEHEAD: JEWELLERY SETTLEMENT CHOICE

PA	FW	O	TOTAL
63 (49)	64 (50)	2 (1)	129 (100)

In view of the concentration on the two cities, coupled with the paucity of trips to "other" settlements, the low position vis-a-vis distance is surprising. The only explanation that can be advanced is that the proportion of consumers located quite far from the two cities and purchasing jewellery is much smaller than the proportion living close to them and purchasing jewellery. In effect, the decline in total visits, from around 160-180 for most items, to 129, is differentially spaced, and the impact of the decline is greater on the peripheral areas of the study area (Figure 4.35, a and b). It is the writer's subjective impression that incomes decline with distance from the two cities and in such a situation jewellery purchases might be the first to suffer.[1] Indeed, a number of respondents in the peripheral area supplemented their negative response to the question on jewellery purchases with the information that they had no money to spare for such luxuries.

Travel for teenage girls' and children's clothes both also record low distances and appraisal of the desire line maps for these items (not presented here) reveals that demand declines with distance from the two cities, as the population increases in general age.

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[1] This impression is strengthened by evidence led in Chapter 6.

The tentative explanation of demand-decline for jewellery with increasing distance from the two cities is reinforced by the patterns of demand and travel for groceries. Demand for groceries is more widespread, yet grocery distances are similar to jewellery's. The equalising factor appears to be use of more dispersed supply points for grocery purchases.

(24) Groceries

The greater role of "other" settlements in consumers' satisfaction of their demands for groceries is apparent from Table 4.54, and the variety of travel patterns to these "other" settlements is more closely detailed in Figure 4.36 (a and b). This high proportion of trips to "other" centres may be held

TABLE 4.54

LAKEHEAD: GROCERIES SETTLEMENT CHOICE

PA	FW	O	TOTAL
70 (37)	80 (43)	37 (20)	187 (100)

responsible for the low overall distances involved in grocery purchases, for consumers in the periphery of the study area need not travel in to the two cities. The high number of trips to "other" settlements appears, from Table 4.54, to be at the expense of Port Arthur. No confirmation of this assertion may be determined from Figure 4.36b but comparing Figure 4.36a with the corresponding pattern of travel for jewellery (Figure 4.35a), the main losses

inflicted by the smaller service centres, such as Lappe, Kaministikwia and Mokomom, are in the Port Arthur service area.

Discussion

While the findings, and their analysis, relating to the spatial behaviour of the dispersed population of the Lakehead area confirm the methodological findings of the Rainy River district study, they raise different substantive issues.

Although the method of comparison employed differs from that utilised in respect of the Rainy River data, the Lakehead area results show that travel distances and travel times correlate so highly that travel distances alone may be used in analysing consumer travel behaviour.

Comparison of last buy and most buy behaviour in respect of both distance and places visited is important in respect of the Lakehead data because of the close juxtaposition of Port Arthur and Fort William and because the survey of establishments suggests little difference between the overall service equipment of the two centres. Under such circumstances the additional distances involved might have negligible effects on consumers' temporal and spatial behaviour patterns. In no instance, however, do the findings suggest significant variation between last buy behaviour and most buy behaviour for both travel distance and settlement choice.

A methodological issue, independent of the Rainy River findings, is clarified. In devising the questionnaire it was possible to request respondents to report use of Port Arthur or

Fort William under the term "Lakehead"; or it was possible to request differentiation to the two settlements in responses. In very few instances did interviewers have to reject the response "Lakehead" and request more accurate identification of place of purchase. Respondents appeared to have very clear ideas of which of Port Arthur or Fort William they had visited, or were in the habit of visiting, for particular items.

In essence, the substantive findings confirm expectations based on perceptions of service equipment of the two centres: in general there is little inter-item distance variation and little inter-item settlement variation. The findings do reveal some divergence from these general patterns: whereas the ranking technique employed ties seventeen items in terms of mean distance travelled, three items are shown to differ from this group and from each other, and five items are shown to differ from this group and to resemble each other. Moreover the actual rankings are difficult to explain. Perhaps unexpectedly, in view of the high proportion of visits to "other" settlements, farm machinery is ranked first. The high ranking of car may be explained by the disproportionate use of Port Arthur, but the high ranking of lawyer is more difficult to explain. Although seventeen items involve no variation in mean travel distance, this homogeneity conceals variation in settlement choice; both intrinsic preference for Port Arthur in respect of refrigerator and furniture; and a comparative preference for Port Arthur in terms of some goods and a comparative preference for Fort William in terms of some services.

Five items are tied in terms of distance, but again the distance homogeneity conceals variations. In the case of groceries

and meat, the low rank may be explained by a diffuse supply system linked with short-distance trips; but in the case of the other three items, there is a strong focus on Port Arthur and Fort William with no significant difference in the number of consumers using either. The explanation suggested is little demand and travel from a proportion of consumers in the periphery of the study area.

The use of the designation "other", in Appendix 13, for all settlements other than Port Arthur and Fort William does little to differentiate use of small settlements lying within the Port Arthur and Fort William tributary areas from use of larger settlements such as Toronto, Winnipeg, Duluth or Minneapolis. The desire line maps, however, reveal that use of such large centres is negligible, for those items for which figures are presented. (It is negligible, too, for those items for which no figures are presented.) Moreover, seventy-seven per cent of the sample indicated that they had not made one visit to any one of the large centres (listed in question number 8 in the questionnaire) for the express purpose of shopping. This is an important finding, it may be suggested, on two counts. Firstly, there is a general impression in the Lakehead area, that the population makes considerable use of Duluth and Minneapolis as sources of consumer items at prices cheaper than they can be obtained in the Lakehead area. The findings suggest that minimal use is made of Duluth and Minneapolis: only ten per cent of the sample reported trips to either of these two cities. Secondly, the findings suggest that Port Arthur and Fort William, singly and in concert, constitute a general pinnacle in terms of consumers satisfying their needs, certainly for goods, and probably for services -- perhaps because no specific question about use of

the large cities for services was directed to respondents.

The patterns revealed in the desire line maps confirm, also, the methodological point about the differentiation of Port Arthur and Fort William. Each centre possesses its won service areas. It is true that the service areas tend to overlap, particularly in the zone extending due west from the common boundary of the two cities, but the overriding impression is of distinct service areas related to two cities. Field experiences and findings suggest that it is erroneous to combine the two cities as one when considering either service equipment or consumer behaviour. Thus Simmons and Simmons (1970) have probably overestimated the importance of the Lakehead, in terms of relative service importance within Ontario, and have concealed the subtle identities of the two cities in terms of service provision (and by implication they have concealed the subtle variations in consumer behaviour linked with the service roles).

The lack of considerable variation in the travel distances involved in the array of items and the actual low mean distances themselves suggest that either catalogue purchases are low, proportionately, or do not vary much from item to item. Inspection of the values set out in Appendix 13 reveals that whereas catalogues are used for purchases of ten items, that use is uniformly negligible in both absolute and relative terms. When questioned generally about use of catalogues, however, thirty per cent of the sample (50 of 192) claimed to have purchased an item by catalogue in the month preceding the interview. Moreover, an additional one hundred persons indicated that they used catalogues at some time or other. Most of those reporting use in the preceding month bought

adult's fashion clothing or children's clothing.

To a certain extent, the evidence is contradictory. From the paucity of reported catalogue purchases of specific items it could be argued that the distances involved for most respondents do not necessitate use of the catalogue; nor, it could be argued, is there the same competition from catalogues when the two cities are able to offer an array of choice, quality goods and comparative price shopping. On the other hand forty-three per cent of those reporting general use of catalogues claimed that they did so to save travelling. Reconciliation of the two lines of evidence is difficult. It may be suggested that the higher use of catalogues, in general reporting, is related to specific items of fashion clothing not covered by the specific questions in the questionnaire, but this is unsatisfactory as the general class of children's clothing was used in both general and specific questions and ran higher (14) in the former than in the latter (4 or 2). A more satisfactory explanation would involve consumers using catalogues to obtain items not available in the two Lakehead cities and to avoid travelling to larger centres, such as Winnipeg or Toronto, where those items are available -- and it has been shown that travel to such larger centres is negligible. In any event, the low reported use of catalogues for specific items precludes any analysis of catalogue-distance relationships.

Rainy River-Lakehead Comparison

The spatial behaviour of the dispersed populations of the Rainy River District and the Lakehead area may be compared in respect

of distances travelled, centres utilised and the use of catalogues.

Although the sample mean is an imprecise summary measure, particularly in the case of the Rainy River consumers, it does provide a comparative estimate of the distances consumers travel. Rainy River consumers' mean travel distances range from *circa* eleven miles for meat to *circa* 180 miles for medical specialist, whereas the Lakehead consumers' mean travel distances range from *circa* eight miles to *circa* fourteen miles. The difference between the two ranges is indicative of the variation in points of supply in the former case and the lack of variation in the latter case. The differences in travel distances can be further highlighted: all of the mean distances travelled by consumers at the Lakehead fall below twenty-three of the twenty-five mean distances travelled by the Rainy River consumers.

In general then, Rainy River consumers travel further than Lakehead consumers. Distance travelled adds to the price of the item and, assuming equal sales prices of items, variation in travel distance will cause variation in the items' prices to consumers. Other things being equal, lower levels of consumption should be found in association with higher travel distances. No specific measures of the amount of each item each consumer obtained were collected, but one indirect measure of the effect of distance on consumption may be provided by the relative proportions of the two total populations consuming particular items.

It is necessary, however, that there should be little variation in the income profiles for the two populations and that only items conceivably applicable to the entire populations be selected for analysis. The sample income profiles for the two

populations are set out in Table 4.55 and the chi-square test demonstrates no significant difference between the income-profiles of the two populations as wholes. It should be noted that the data represent total family incomes.

TABLE 4.55

RAINY RIVER & LAKEHEAD: SAMPLE INCOME PROFILES

Income Band($)	Rainy River		Lakehead	
3,000	33	(24%)	44	(33%)
3,000 - 5,999	33	(32%)	57	(33%)
6,000 - 8,999	26	(30%)	54	(26%)
9,000 - 11,999	4	(10%)	18	(4%)
12,000	4	(4%)	8	(4%)
Total	100	(100%)	181	(100%)
Refused	2		11	

($X^2 = 5.03$; critical value, $X^2 = 9.49$, 4 df at 0.05)

Accordingly variations in consumption between the two populations cannot be especially ascribed to income variations.

If it is assumed that the Rainy River dispersed population is not radically different from the Lakehead dispersed population in health, tastes and attitudes, it may be argued that levels of consumption should be similar. To test this hypothesis the total number of consumers, in both Rainy River and at the Lakehead, travelling to purchase each item was abstracted from Appendix 13 and expressed as a percentage of the respective total numbers of respondents (first two columns of Table 4.56). If there is no

TABLE 4.56

RAINY RIVER & LAKEHEAD: COMPARATIVE CONSUMPTION

	Travel %'s		Travel & Cat. %'s	
	R.R.	L.	R.R.	L.
Medical specialist	44	70*	44	70*
Optometrist	79	80	79	80
Car	90	89	90	89
Lawyer	68	80	68	80
Women's coat	59	93*	93	93
Furniture	59	88*	78	93
Jewellery	57	67	65	67
Dentist	97	91	97	91
Men's coat	72	95*	93	95
Watch	79	79	79	80
Refrigerator	90	88	96	89
Men's work clothes	72	95*	94	95
Women's shoes	64	96*	93	96
Bank	95	97	95	97
Teenage girls' clothes	20	26	34	27
Drugs	96	98	98	98
Children's clothes	28	59*	45	60
Hospital	96	97	96	97
Car insurance	89	93	89	93
Men's shoes	82	97	94	97
Family doctor	98	100	98	100
Television	77	89	83	89
Groceries	98	97	98	97
Meat	78	92	78	92

* Significant difference: Lakehead consumption is greater.

difference in the level of consumption between the two populations, then the absolute numbers for each item should follow the ratio 1:1.88 (Rainy River 102 respondents, Lakehead 192 respondents). The chi-square test may be used to determine whether or not sample differences are significant.

H_0: There is no difference in the ratios

H_1: The population from which the larger of the two sample values is drawn is greater than that from which the smaller sample is drawn. (This alternative hypothesis is directional, therefore the critical region for acceptance of H_1 is $X^2 = 2.71$ or greater, at 0.05, rather than $X^2 = 3.84$ or greater -- critical region for acceptance with non-directional hypothesis.

The alternative hypothesis is accepted in the cases of seven items, one service and six goods: medical specialist, women's coat, furniture, men's coat, men's work clothes, women's shoes, and children's clothes. With these two samples a difference of some twenty per cent in the pairs of sample values appears necessary for the existence of a true difference.

To the absolute sample values of items obtained by the consumer travelling to purchase them have been added the absolute sample values of items obtained by the consumer utilising catalogues. These values are expressed as percentages of the total number of respondents in the two areas (second two columns in Table 4.56). The general effect of adding purchases by catalogue is to increase the Rainy River consumption levels so that they compare more favourably with the Lakehead consumption levels. Application of the chi-square test to each pair of absolute values, represented by the percentages in the last two columns, in a fashion identical with that adopted for the first two columns, shows that only one

significant difference in consumption levels remains: medical specialist. The utilisation of catalogues has evened out differences in consumption levels in respect of goods.

This section of the comparative discussion may be concluded. The sample distances suggest that Rainy River residents travel farther than Lakehead residents for most items. As travel distances add to the price of items for consumers, it is to be expected that consumption levels in Rainy River will be lower than at the Lakehead, and the comparison shows that the expectation holds true for seven items. The overwhelming reason given for use of catalogues by the Rainy River respondents is that of "saves travelling". Inclusion of catalogue purchases for both areas eradicates all differences, except that of medical specialist -- a service demanding face-to-face contact. Thus it would appear that a proportion of the Rainy River dispersed population is unable or unwilling to travel distances similar to those indicated by the sample distances, for the array of choice and quality of good available at those distances; or is unwilling to travel farther than those distances to obtain an improved array of choice and quality of good. Purchase by catalogue is substituted for purchase by travel.

Because the sample mean travel distances are suspect, items in both areas are ordered on the basis of differences between complete sets of travel distance by means of the rank sum test. The two orders (Tables 4.10 and 4.39) may be tested by Spearman's test for the rank-order coefficient of correlation. To aid comparison, the two different orders are set out in Table 4.57. Application of Spearman's test yields a value of + 0.48 which is significant at 0.05.

TABLE 4.57

RAINY RIVER AND LAKEHEAD:
ORDERS OF ITEMS -- RANK-SUM TEST

Medical specialist	1	12
Optometrist	2	12
Car	3	2
Lawyer	4	3
Women's coat	6.5	12
Furniture	6.5	12
Jewellery	6.5	23
Dentist	6.5	12
Men's coat	9	12
Watch	10	12
Refrigerator	15	12
Farm machinery	15	1
Men's work clothes	15	12
Women's shoes	15	12
Bank	15	12
Teenage girls' clothes	15	23
Drugs	15	12
Children's clothes	15	23
Hospital	15	12
Car insurance	21	12
Men's shoes	21	12
Family doctor	21	12
Television	24	12
Groceries	24	23
Meat	24	23

Because of the numerous ties, in both orders, the appropriate formula, including a correction for ties, provided by Siegel (1956, p. 203) has been used.

$$p = \frac{\Sigma x^2 + \Sigma y^2 - \Sigma d^2}{2\sqrt{\Sigma x^2 \Sigma y^2}}$$

Application of this formula to the two orders yields a value p = + 0.35, which also is significant at 0.05. In this case, whereas the correction for ties has reduced the value of p, it has not reduced it enough to render the positive correlation between

the two orders insignificant.

Although there is a positive correlation between the two orders, and although the large number of ties renders comparison of the two ranks of the same item difficult, certain anomalies may be perceived. Perhaps the most striking anomaly is provided by farm machinery, ranked first at the Lakehead and tied in fifteenth place in Rainy River. Equally, medical specialist, which is ranked first in Rainy River, is tied in twelfth rank at the Lakehead; and optometrist, ranked second in Rainy River, is also tied at twelfth rank at the Lakehead.

The greater distances generally travelled by the Rainy River population reflect, in part, the greater dimensions of the Rainy River area compared with the area of dispersed population at the Lakehead; but they also represent the need of the population to make journeys outside of the region. These greater distances themselves suggest that the Rainy River consumers are part of a service system different from that in which the Lakehead consumers satisfy their needs and wants. It would appear that Winnipeg represents the pinnacle of the system with which the Rainy River consumers interact and that the cities of Port Arthur and Fort William occupy the same position in the spatial behaviour of Lakehead consumers. Generally the former group look westwards, the latter eastwards.

Thus the spatial behaviour of the two regions of dispersed population considered here support the view (Chapters 3 and 5) that two systems of service provision exist in Northwestern Ontario. An examination of the spatial behaviour of Northwestern Ontario's population nucleations is required to provide verification, and perhaps elaboration.

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CHAPTER 5

CONSUMER BEHAVIOUR: NUCLEATED POPULATION

INTRODUCTION

The 1966 *Census of Canada* classifies 71.5 per cent of the Northwestern Ontario population as urban but a higher percentage of the population than this lives in settlement nucleations; due to the lack of incorporation of many places, however, a precise percentage cannot be given. In the present chapter the consumer behaviour of this nucleated population is examined and, for reasons subsequently explained, there is an emphasis on the larger nucleations. More specifically, the tributary areas of Winnipeg and the Lakehead cities are delimited; items are ranked on a basis of distances travelled; the structure of consumer behaviour is examined; the spatial patterns of travel behaviour for eight items are described and analysed in detail; and differential patronage of Port Arthur and Fort William is singled out for special study.

TRIBUTARY AREA DELIMITATION

It is generally recognised that service centres provide goods and services over an area contiguous with themselves and that the higher the rank of the service centre the more extensive is this contiguous area. There is a variety of terms

to describe this contiguous area: sphere of influence, hinterland, umland, tributary area, ~~urban field,~~ supporting area and urban field. The area of influence of the service centre is in turn made up of the zones of influence of each of the items provided by the service centre for the contiguous area and a variety of descriptive terms also exists here: drainage areas, catchment areas and service areas. In this study the term "service area" defines the zone from which consumers travel to a service centre to obtain there a specific good or a specific service; and the term "tributary area" defines the zone which is composed of the amalgam of the service areas of the twenty-four items selected for examination in this study. Three methods of tributary area delimitation are discussed below: newspaper circulation area, hospital service area and areas of consumer travel.

Newspaper Circulation

The use of newspaper circulations to infer the extent of tributary areas is discussed in Chapter Two. The validity of the inference is based on the notion that those purchasing a newspaper not only do so to obtain general news and news about the service centre in which the newspaper is published, but also to examine advertisements for retail goods being sold at the service centre. It is also pointed out in Chapter Two that newspaper circulation may allow valid inference of the amalgam of service areas for retail goods but not of the amalgam of service areas for professional services.

In Northwestern Ontario, weekly newspapers are published at Terrace Bay, Marathon, Manitouwadge, Geraldton, Dryden, Fort Frances, Kenora and Rainy River. Audit Bureau of Circulations (ABC) data are not available for these newspapers but on the basis of field investigation it is thought that their areal circulations are restricted to the centres in which they are published.[1] The only daily newspapers published in Northwestern Ontario are the Port Arthur *News-Chronicle* and the Fort William *Times-Journal* and aspects of their circulations are shown in Figure 5.1. Other daily newspapers received in the region are principally the Toronto *Globe and Mail* and the *Winnipeg Free Press*. Data on the copies of the *Globe and Mail* distributed from the Lakehead were obtained but these are omitted from Figure 5.1 as this newspaper carries no advertisements for Northwestern Ontario service establishments and little Northwestern Ontario news. Audit Bureau of Circulations data for the *Winnipeg Free Press* could not be obtained but field observation suggests that this newspaper's circulation is mainly in the western part of Northwestern Ontario, west of a line joining Sioux Lookout, Dryden and Fort Frances.

Before the circulation patterns shown in Figure 5.1 are analysed, the data require explanation. The number of copies represented for a place is composed of the number of copies supplied by the publishers to carriers and dealers based in that

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[1] Also published weekly, in Port Arthur, is the *Canadan Uutiset*, a Finnish-language newspaper. Details of its circulation are given in Appendix 14 and the area of circulation is, of course, defined by the distribution of Finnish-speaking people.

place, the number of copies mailed out to subscribers with mailing addresses at the place, and the number of copies distributed by motor route originating in that place. Consequently, the number of copies distributed to a place does not necessarily equate with the number of copies sold to its residents: because dealers may sell to a transient clientele, non-residents may collect their mail there and motor-routes involve delivery to non-residents as well as to residents. Accordingly, the data represented for each place in Figure 5.1 should be interpreted as expressing the tie between the Lakehead cities and an undefined area centred on that place. Finer details of circulation are contained in Appendix 14 and gross details are as follows (Table 5.1):

TABLE 5.1

LAKEHEAD NEWSPAPERS' CIRCULATIONS, 1966-67

	Port Arthur *News-Chronicle*	Fort William *Times-Journal*
Home settlement	11,057	11,745
NWO rep. in Fig. 5.1	2,295	3,121
NWO not rep. in Fig. 5.1	1,535	1,634
Extra - NWO	222	516
	15,109	17,016

Source: ABC, Audit Reports for *News-Chronicle* and *Times-Journal*

The *Times-Journal*'s total circulation exceeds that of the *News-Chronicle* by nearly 2,000 copies and it exceeds it in all of the categories into which total circulation has been disaggregated. Figure 5.1 is based on the second category of Table 5.1: the number of copies sold in each home-settlement (that is, *News-Chronicle* sales in Port Arthur and *Times-Journal* sales in Fort William)is not represented due to cartographic difficulties of accommodating over 11,000 copies within a scale designed to show variations in the low hundreds. Moreover, over 1,500 copies of both newspapers sold in Northwestern Ontario are not represented: location data on the sales of these copies are not recorded in ABC reports as the sales occur in units of less than twenty-five.

The data represented in Figure 5.1, then, show that all the main settlements to the east of the Lakehead receive copies of both Lakehead newspapers in differing quantities. There appears to be little pattern: whereas sales of the *News-Chronicle* exceed those of the *Times-Journal* at Nipigon and Red Rock (close to the Lakehead), sales of the *Times-Journal* exceed those of the *News-Chronicle* at Schreiber and Geraldton (farther away); and still farther away, sales of the *News-Chronicle* exceed those of the *Times-Journal* at Marathon. To the west of the Lakehead, with the exception of Red Lake which receives only the *News-Chronicle*, the *Times-Journal* either outsells the *News-Chronicle* or is the only newspaper of the two to register sales.

The larger and more areally extensive circulation of the *Times-Journal* suggests a greater interest over Northwestern

Ontario in events in Fort William (and perhaps with items sold there) than in events in Port Arthur. Evidence is presented subsequently in this chapter suggesting that the reverse is the case: that residents of most places within the combined tributary areas of Port Arthur and Fort William exhibit a preference to patronise Port Arthur for goods and services. In judging the validity of inferring tributary areas from newspaper circulation data, it is perhaps true to hold that little about differential patronage can be asserted on the basis of newspaper circulation; but sales of both newspapers tend to delimit a Lakehead tributary area which corresponds closely to that delimited by analysis of consumer behaviour, with the exceptions of Dryden, Ignace and Sioux Lookout.

Hospital Admissions

One convenient way of delimiting service centres' tributary areas is to infer these from a particular service area identified on the basis of complete information.

The writer was fortunate in obtaining standardised information on the domiciliary distribution of patients admitted to the Lakehead's three major hospitals during the calendar year 1966; but before this information is presented and analysed, the pattern of hospital provision in Northwestern Ontario should be described. There are small hospitals at Fort Frances, Emo, Rainy River, Red Lake, Kenora, Dryden, Nipigon, Geraldton, Sioux Lookout, Atikokan, Balmertown, Terrace Bay, Marathon and

Manitouwadge. Hospitals in the last four places named are intended to serve primarily employees of the companies operating in those towns but non-employees and non-residents in need may receive treatment. At these hospitals basic medical attention may be received but patients requiring more advanced facilities and medical care must receive attention elsewhere. For Northwestern Ontario, advanced medical care is either provided in the Lakehead hospitals or in Winnipeg; more rarely are visits to Toronto hospitals required. Various types of hospital are located at the Lakehead (Table 5.2).

TABLE 5.2

LAKEHEAD: HOSPITAL PROVISION, 1966

City	Name	Actual Bed Capacity
F.W.	McKellar	373
P.A.	General	291
P.A.	St. Joseph's	168
F.W.	Sanitorium	270
F.W.	Westmount	150
F.W.	Grandview Lodge	165
P.A.	Dawson Court	245
P.A.	Ontario Psychiatric	1,018

Grandview Lodge and Dawson Court are homes for the aged (and usually incapacitated), where varying degrees of medical care are rendered. Grandview Lodge is financially supported by the City of Fort William and six neighbouring rural municipalities; and Dawson Court is financially supported by the City of Port Arthur and the Municipality of Shuniah. Residents of

the homes formerly dwelled in the respective areas supporting the institutions. The Ontario Psychiatric Hospital serves the whole of Northwestern Ontario and is supported by funds supplied by the Ontario Provincial Government. Fort William Sanitorium, which caters primarily for those suffering from respiratory and pulmonary afflictions, and Westmount hospital, which admits directly the chronically sick, both act as convalescence homes for patients who have undergone operations or treatment at the other three hospitals: McKellar, Port Arthur General, or St. Joseph's. None of these three hospitals has an administratively defined area which it serves and no-one is turned away in an emergency. Admission to one of these hospitals, however, is normally effected on the recommendation of a local physician (that is a physician with a practice based in either Fort William or Port Arthur). If a patient under the care of a physician based outside the Lakehead requires specialised treatment, that physician normally contacts a local physician who in turn arranges hospital admission at the Lakehead.

The numbers of admissions from twenty-two Northwestern Ontario settlements to Lakehead hospitals during 1966 are listed in Table 5.3. These numbers have been converted to percentages of the settlements' populations and these percentages are the basis of Figure 5.2, in which circle size is proportional to a settlement's total population.

Figure 5.2 demonstrates the service area of the Lakehead hospitals: from Manitouwadge in the east to the Ignace-Atikokan axis in the west. To the west of this axis

percentage use of Lakehead hospitals is negligible (less than one per cent) and the sample survey reveals that from here the focus is on Winnipeg hospitals.

TABLE 5.3

DOMICILIARY DISTRIBUTION OF LAKEHEAD HOSPITAL ADMISSIONS, 1966

Place	Port Arthur		Fort William		Total
	No.	% Pop.	No.	% Pop.	% Pop.
Port Arthur*	8,039	16.7	545	1.1	17.8
Fort William*	411	0.9	10,241	21.2	22.1
Nipigon*	143	5.3	71	2.6	7.9
Red Rock	98	3.4	76	3.8	7.2
Schreiber	118	5.4	47	2.1	7.5
Terrace Bay*	70	3.6	27	1.4	5.0
Marathon*	77	2.9	20	0.8	3.7
Manitouwadge*	73	2.3	12	0.4	2.7
Beardmore	45	4.2	87	8.2	12.4
Geraldton*	142	3.9	41	1.1	5.0
Longlac	52	3.9	26	2.0	5.9
Makina	17	2.5	10	1.5	4.0
Atikokan*	179	2.8	102	1.6	4.4
Fort Frances*	54	0.6	39	0.4	1.0
Emo*	6	0.5	0	0	0.5
Rainy River*	2	0.2	5	0.4	0.6
Dryden*	34	0.5	29	0.4	0.9
Kenora*	3	0.0	4	0	0.0
Red Lake*	0	0.0	2	0	0.0
Balmertown*	0	0.0	0	0	0.0
Sioux Lookout*	6	0.2	2	0.2	0.4
Ignace	21	2.6	27	3.4	6.0

* Settlements with hospitals

Source: Port Arthur General Hospital admission records; McKellar Hospital admission records; St. Joseph's Hospital admission/discharge forms; Ontario Hospital Services Commission records.

The percentages of Port Arthur's and Fort William's populations using hospitals in the alternate city are very close (1.1% and 0.9% respectively, Table 5.3) but, otherwise, the percentages of most settlements' populations using Port Arthur hospitals exceed those using the Fort William hospital. Of the twenty places other than Port Arthur and Fort William listed in Table 5.3 only Ignace, Beardmore and Rainy River show greater percentage use of the Fort William hospital. It may be suggested that the greater number of beds (459, Port Arthur; 373, Fort William: Table 5.2) and the higher number of physicians (69, Port Arthur; 54, Fort William: Appendix 11), combined with the preferences of referring physicians, provides a substantial explanation of the difference; rather than any preference on the part of patients.

Comment on differences over the tributary area in the intensity of use of Lakehead hospitals depends on the assumption that there is little or no areal variation in the need for specialised hospital facilities. If it is assumed that there is an equilibrium between need and satisfaction for all types of hospital facilities at the Lakehead, there is on the basis of admissions (representing satisfaction) a difference of 4.3 per cent between Port Arthur and Fort William.

To eliminate the areal variation of the presence or absence of "cottage" hospitals, only settlements with them are considered (Figure 5.3). Nipigon, fifty-nine miles from the Lakehead, exhibits a 7.9 per cent use of Lakehead hospitals; whereas Manitouwadge, 224 miles from the Lakehead, exhibits a 2.7 per cent use of Lakehead hospitals. It could be argued that

the decline of 5.2 per cent represents either improvement in the hospital facilities with increasing distance from the Lakehead (and, therefore, not so much need to travel to it) or decreasing willingness of consumers to avail themselves of specialised hospital facilities as distance increases. Certainly, if the patient is seriously ill he will have to travel to the Lakehead; but when facilities are far away diagnostic and confirmatory work may be put off for some time, perhaps indefinitely.

Consumer Travel Behaviour

In Chapter Two it is argued that information on consumer travel behaviour is integral to the ranking of service centres to ensure that centres from different systems are not considered together and in Chapter Three centres are assigned either to the Lakehead system or to the Winnipeg system. Evidence for the assignments is presented here.

Scrutiny of all of the data on consumer travel behaviour in Northwestern Ontario indicated that nucleations to the east of the Lakehead are firmly within the Lakehead tributary area and that nucleations in the west of the study area are firmly within the Winnipeg tributary area; and that the area of doubt was in the vicinity of Atikokan, Ignace and Upsala. Further, this indication is supported by inferences based on newspaper circulation and the domiciliary distribution of hospital admissions. In assigning these doubtful nucleations to one or another of the two

systems, the low absolute travel to other places in the case of Atikokan and the low numbers in the samples at other nucleations causes difficulties. In analysing the returns from a consumer behaviour survey in rural Wales, G. Rowley (1971, p.537) seems to imply that low numbers in samples can be partly compensated for by employing percentages:

> The sample was larger in areas of low population density than in areas of higher density, but the use of percentages partly overcame this deficiency consequent upon poor census returns at this level.

It is difficult to see how conversion to percentages increases the significance of results. For example, the use of centres in the Winnipeg and Lakehead systems by Atikokan residents is shown in Table 5.4.[1] Utilising solely percentages based on sample figures, Atikokan residents use the Lakehead system more than the Winnipeg system for sixteen items out of twenty-four. Utilising the sample figures, however, the amount of travel to both systems is high enough to allow a significance test (chi-square) to be performed on only five items (men's coat, jewellery, car, lawyer, and optometrist) and for only three of them can significant preferences be established. All that may be said about the other twenty-one items is that fourteen of them show a tendency for the Lakehead system to be preferred, three a preference for the Winnipeg system, and four no difference. In

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[1] Use of Fort Frances, previously assigned to the Winnipeg system, by Atikokan residents, as well as use of Winnipeg itself, is designated as use of the Winnipeg system.

aggregate, there is a significant preference for the Lakehead system. It is as well to emphasise, then, that Atikokan is assigned to the Lakehead system on the basis of three significant items out of twenty-four, the tendency of fourteen other items and an aggregate score.

At Dinorwic, Ignace, Upsala and Raith the numbers in the samples are too low to allow any tests of significance for individual settlements to be performed (3, 9, and 2 respectively) and these four places are assigned to a system of the basis of the tendency indicated by the sample figures: Dinorwic, 100 per cent of travel for each of twenty-four items to the Winnipeg system,is assigned to that system; Ignace,twenty-one items purchased in the Winnipeg system and three items (car, medical specialist and optometrist) purchased in the Lakehead system, with an average of *circa* eighty per cent of travel for those twenty-one items being in favour of the Winnipeg system,is assigned to the Winnipeg system; Upsala and Raith(100 per cent of travel for each of twenty-four items is to the Lakehead system)are assigned to the Lakehead system.

The system to which each nucleation is assigned is shown in Figure 3.11 and the patterns shown in Figure 3.11 may be compared to those shown in Figures 5.1 and 5.2. It would appear that, if the assignment indicated in Figure 3.11 is correct, the inference of a Lakehead tributary area as far west as Ignace, Dryden and Sioux Lookout is incorrect. It is subsequently shown that there is a small amount of travel to the Lakehead from Dryden, Sioux Lookout and Fort Frances for some

TABLE 5.4

ATIKOKAN: USE OF LAKEHEAD AND WINNIPEG SYSTEMS

	Lakehead System		Winnipeg System	
	No.	%	No.	%
MWC	2	50	2	50
WS	7	100	0	0
MS	3	75	1	25
TGC	3	100	0	0
CC	3	75	1	25
MC	8	72.7	3	27.3
WC	6	66.6	3	33.4
Drugs	3	75	1	25
Groceries	0	0	1	100
Meat	1	50	1	50
T.V.	3	37.5	5	62.5
Refrigerator	4	66.6	2	33.4
Furniture	4	57.1	3	42.9
Watch	5	55.5	4	44.5
Jewellery	6	60	4	40
Car *	13	81.3 *	3	18.7
Farm Doc.	3	100	0	0.0
Med. Spec.	3	33.4	6	66.6
Dentist	4	50	4	50
Lawy. *	10	83.3 *	2	16.7
Car.Ins.	1	50	1	50
Optometrist *	12	85.7 *	2	14.3
Hospital	5	100	0	0
Total *	109	69 *	49	31

* Significant difference at 0.05 level.

items; but the explanation for the circulation of Lakehead-based newspapers this far west would seem to be more connected with residents wishing to keep up with Northwestern Ontario news

and Ontario news generally, which they can do more readily by reading a Lakehead-published newspaper than a Winnipeg-published newspaper. On the other hand, the tributary area inferred from the pattern of domiciliary distribution of hospital admissions (Figure 5.2) corresponds well with the pattern shown in Figure 3.11.

DISTANCE DATA

The starting point for consideration of travel distances by item is the mean and three mean travel distances may be calculated: (1) the extra-nucleation mean, (2) the travel mean and (3) the true mean.[1] The extra-nucleation mean is obtained by dividing the aggregate distance of trips outside of home-settlements by the number of trips. The travel mean is obtained by dividing the aggregate distance of trips to points outside of and within home-settlements by the number of trips. The true mean is obtained by dividing the aggregate distance of trips to points outside of home-settlements and within home-settlements and distances involved in catalogue purchases by the number of trips.[2] Because travel within home-settlements is judged to involve zero distances, distances

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[1] These three means are all sample means; therefore, the (sample) true mean (3) should not be confused with the (population) true mean.

[2] Where there are no catalogue purchases, as with services, travel and true means coincide.

of nought are added to the extra-nucleation aggregate; and, similarly, catalogue purchases involve no travel. In effect, the aggregate distance is held constant in each case and the number of trips is increased. Thus, it is to be expected that travel means will be lower than extra-nucleation means and that true means will be lower than travel means. For example, the aggregate distance travelled for television purchase is 24,243.7 miles. Three hundred and fifty-four consumers travel outside of their home-settlements to purchase televisions, therefore the extra-nucleation mean is 68.5 miles. Six hundred and seventy-two consumers buy televisions in their home-settlements; therefore, dividing the aggregate distance by 1,026, the travel mean is 23.6 miles. Thirty-two consumers effect purchase via catalogues; therefore, dividing the aggregate distance by 1,058, the true mean is 22.9 miles.

Northwestern Ontario

The extra-nucleation means (Appendix 15) range over 107.8 miles: from a high of 145.3 miles (medical specialist) to a low of 37.5 miles (bank). The extra-nucleation means tend to decrease gradually over the range, with three suggestions of clustering: car, furniture, men's coat and teenage girls' clothes; jewellery, watch, children's clothes and refrigerator; and family doctor, hospital, groceries and drugs. There appear to be two main breaks in the pattern: between medical specialist and women's coat (at 40.4 miles); and between drugs and bank (at 11.2 miles). The range of the travel means is

only slightly lower (106.7 miles): from a high of 117.4 miles (medical specialist) to a low of 11.2 miles (bank) and the effect of basing rank-ordering of items on the travel means may be judged by examining Figure 5.4: teenage girls' clothes would be raised above men's coat; refrigerator and men's shoes would be raised above jewellery, watch and children's clothes; and family doctor, hospital and drugs would be raised above meat. This rearrangement, however, would not radically affect the rank-ordering of items based on extra-nucleation means. The general effect of adding catalogue purchases is to lower the travel mean only slightly; but it tends to lower greater travel means by more than it lowers smaller travel means. For example, women's coat, the second-ranked travel mean (53.6 miles), is lowered by 6.9 miles (to 46.4 miles) while television, the seventeenth-ranked travel mean (23.6 miles) is lowered by 0.7 miles (to 22.9 miles). One conclusion that may be drawn from this general pattern is that catalogues are used more as a way of reducing long distances travelled, rather than being used to increase array of choice. If, however, those items for which high extra-nucleation means are registered are those for which wide arrays of choice are also required, it is difficult to separate out the two influences.

The validity of using mean travel distances derived from skewed distance-distributions is queried in Chapter Four and these distance distributions are also severely-skewed. Accordingly the rank-sum test is used to rank items; but, because of the high proportion of zero scores in the travel

and true distance-distributions (which produces a large number of ties) the rank-sum test cannot be used to compare the travel means of different items with each other, the true means of different items with each other, or the travel means with the true means for the same item. Its use, therefore, is restricted to an inter-item comparison of extra-nucleation means.

Inter-item comparison of extra-nucleation distance distributions for twenty-four items was effected using the rank-sum test and items initially ranked on a basis of sample mean distances were re-ranked according to the number of items they exceed (the procedure is identical to that explained in Chapter 4). The resulting rank-ordering of items is shown in Table 5.5, where there is one anomaly (in the cell defined by teenage girls' clothes and men's shoes). Three definite clusters of items may be perceived: women's coat, optometrist and lawyer; from men's work clothes to family doctor; and from television to bank. Repeating the results in Chapter Four, medical specialist is similar to no other item and exceeds all other items in distances travelled. Despite the rearrangement of items, a significant rank-order coefficient of correlation of $p = + 0.98$ exists between the rank-ordering of items based on the rank-sum test and that based on the sample distance means. Table 5.5 has been used as a basis of selection of items for detailed examination of spatial behaviour subsequently in this chapter: medical specialist and bank, the highest-ranked and lowest-ranked items;

TABLE 5.5

NORTHWESTERN ONTARIO: ADJUSTED RANKING OF ITEMS

		Ms	Wc	Op	Ly	Mc	Tgc	Ws	Ca	Fu	Wa	Jew	CC	Ms	Frig	Mwc	Mt	Dent	G	CI	FD	TV	D	H	B	
1	M.Sp	-	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	*
3	Wc		-	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	*
3	Opt			-	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
3	Law				-	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
5	Mc					-	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	
7	Tgc						-	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	
7	Ws							-	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	*
7	Car								-	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	
9	Fur									-	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	
10.5	Wa										-	0	0	0	0	1	1	1	1	1	1	1	1	1	1	
10.5	Jew											-	0	0	0	1	1	1	1	1	1	1	1	1	1	
12	Cc												-	0	0	0	0	1	1	1	1	1	1	1	1	
13	Ms													-	0	0	0	0	0	1	1	1	1	1	1	*
14	Frig														-	0	0	0	0	0	1	1	1	1	1	
17.5	Mwc															-	0	0	0	0	0	0	0	0	1	
17.5	Meat																-	0	0	0	0	0	0	0	1	
17.5	Dent																	-	0	0	0	0	0	0	1	*
17.5	Groc																		-	0	0	0	0	0	1	*
17.5	CI																			-	0	0	0	0	1	
17.5	F.Doc																				-	0	0	0	1	
22.5	TV																					-	0	0	0	
22.5	Dru																						-	0	0	
22.5	Hos																							-	0	
22.5	Bank																								-	*

women's coat and lawyer, a good and a service from a cluster of high-ranked items; women's shoes and men's shoes, items separated in rank and drawn from a descending rank-sequence; dentist and groceries, a service and a good drawn from a cluster of low-ranked items.

It is pointed out in Chapter Three and earlier in this chapter that two systems of service centre exist in Northwestern Ontario. The nucleations have been assigned to their respective systems and distance data similar to that calculated for the whole of Northwestern Ontario have been generated for each system.

Lakehead System

The extra-nucleation means range from a high of 102.8 miles (medical specialist) to a low of 47.6 miles (television), a span of 55.2 miles (Figure 5.5 and Appendix 15). The extra-nucleation means of optometrist and lawyer are close to that of medical specialist (99.2 miles and 86.9 miles respectively) and also close to each other. These three items seem to cluster well above all other items. The extra-nucleation means of the other items also show a tendency to cluster and they decrease gradually from 76.5 miles (jewellery) to 60.9 miles (refrigerator); and decrease more sharply to family doctor (58.1 miles), bank (52.6 miles) and television (47.6 miles). The comparatively high means of medical specialist, optometrist and lawyer suggest a distribution of provision more severely restricted than that of other items and

the concentration of medical specialist and lawyer services in Port Arthur and Fort William is detailed subsequently in this chapter. The clustering of the other sample extra-nucleation means at a lower level suggests that, whereas provision of these items is not as restricted spatially as the three professional services mentioned above, the same service centres are being utilised for each item. The lack of spatial variation in consumer travel is shown subsequently.

The travel means range over 60.2 miles, from a high of 77.2 miles (medical specialist) to a low of 17.0 miles (television). The major effect of re-ranking the items on the basis of travel means would be to raise furniture from seventh rank to fourth and car from fifteenth to sixth; and to lower jewellery from fourth to ninth. Noticeably, the 3.6 miles which separates the extra-nucleation means of medical specialist and optometrist is widened to 27.7 miles when travel means are considered: the effect of home-settlement provision on the medical specialist extra-nucleation mean is much less marked than the effect on that of optometrist, suggesting that medical specialist facilities are indeed more spatially restricted than those of optometrist.

The maximum decrease in mean distance caused by including catalogue purchases is experienced by women's coat (4.2 miles). Generally, the decrease in means so caused is more pronounced for items with higher travel means than with lower travel means (Figure 5.5).

The possibility of medical specialist, optometrist and lawyer resembling each other, suggested by consideration of Figure 5.5, is confirmed by the pattern of rank-ordering established by application of the rank-sum test to the twenty-four items' extra-nucleation distance distributions (Table 5.6): these three items do form a group in that they do not differ from each other and exceed the same twenty-one items. The next-ranked item (jewellery) exceeds only eleven items while the fifth-ranked item (means' coat) exceeds only seven items. A three-member group of women's coat, women's shoes and meat exceeds six items, while a nine-member group between furniture and dentist exceeds only three items.[1] A five-member group extending from car insurance to refrigerator exceeds television (the lowest-ranked item) which is similar in travel distance to no other item. Of the twenty four items, only four exceed unique numbers of other items and the overall impression is one of grouping of items. A similar impression is gained from considering Figure 5.5. Quantitative comparison of the two rank-orders using the test for rank-order co-efficient of correlation yields a significantly high value, $p = + 0.97$.

Winnipeg System

The same types of mean distances have been generated

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[1] The anaomalous men's work clothes-bank value is disregarded.

TABLE 5.6

LAKEHEAD SYSTEM: ADJUSTED RANKING OF ITEMS

		Msp	Opt	Law	Jew	Mc	Wc	Ws	Meat	Ms	Fur	Tgc	Wa	Cc	Dr	Groc	Hos	Mwc	Dent	CI	FD	Car	Bank	Frig	TV
1	Msp	-	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1	Opt		-	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1	Law			-	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
4	Jew				-	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
5	Mc					-	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
7	Wc						-	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1
7	Ws							-	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1
7	Meat								-	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1
9	Ms									-	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1
14	Fur										-	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1
14	Tgc											-	0	0	0	0	0	0	0	0	0	0	1	1	1	1
14	Wa												-	0	0	0	0	0	0	0	0	0	1	1	1	1
14	Cc													-	0	0	0	0	0	0	0	0	1	1	1	1
14	Dru														-	0	0	0	0	0	0	0	1	1	1	1
14	Groc															-	0	0	0	0	0	0	1	1	1	1
14	Hos																-	0	0	0	0	0	1	1	1	1
14	Mwc																	-	0	0	0	0	1	1	1	1
14	Dent																		-	0	0	0	0	1	1	1
21	CI																			-	0	0	0	0	1	1
21	F.Doc																				-	0	0	0	1	1
21	Car																					-	0	0	1	1
21	Bank																						-	0	1	1
21	Frig.																							-	1	1
24	TV																								-	1

for the twenty-four items and these are represented in Figure 5.6.[1] The extra-nucleation distance means range from a high of 175.5 miles (medical specialist) to a low of 19.1 miles (bank). This medical specialist mean appears to be much higher than the next-ranked item, women's coat (129.2 miles); and there appears to be a cluster of gradually declining means extending from furniture (111.8 miles) to men's shoes (77.4 miles). The pattern of rank-ordering of items based on extra-nucleation means is maintained in a general way by the travel means, except that both men's coat and children's clothes are lower in rank. The striking contrast, however, is provided by the medical specialist travel mean, which exceeds the second-ranked women's coat extra-nucleation mean. Thus the travel means range from a high of 149.9 miles (medical specialist) to a low of 3.5 miles (groceries), a span of 146.4 miles. The addition of catalogue purchases serves to lower travel means by about two to four miles, with the maximum reduction of 9.4 miles being experienced by women's coat. As with the Lakehead system, catalogue purchases tend to exert a more pronounced lowering effect on the travel means of higher-ranked items than on those of lower-ranked items.

The relationships shown in Figure 5.6 suggest a spatial concentration of medical specialist facilities in the Winnipeg system even greater than that suggested for the Lakehead system

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[1] It should be noted that the vertical scale in Figure 5.6 is 1" to 20 miles, whereas it is 1" to 10 miles in Figures 5.4 and 5.5.

TABLE 5.7

WINNIPEG SYSTEM: ADJUSTED RANKING OF ITEMS

		Msp	Wc	Car	Fu	Mc	Opt	Tgc	Frig	Ws	Cc	TV	Wa	Jew	Ms	Mwc	CI	Law	Dent	FD	Dru	Hos	B	M	G
1	Msp	-	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2	Wc		-	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
3	Car			-	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
5	Fur				-	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
5	Mc					-	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
5	Opt						-	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
7.5	Tgc							-	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1
7.5	Frig								-	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1
9	Ws									-	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1
11.5	Cc										-	0	0	0	0	0	0	1	1	1	1	1	1	1	1
11.5	TV											-	0	0	0	0	0	1	1	1	1	1	1	1	1
11.5	Wa												-	0	0	0	0	1	1	1	1	1	1	1	1
11.5	Jew													-	0	0	0	1	1	1	1	1	1	1	1
14	Ms														-	0	0	0	1	1	1	1	1	1	1
15.5	Mwc															-	0	0	0	0	1	1	1	1	1
15.5	CI																-	0	0	1	1	1	1	1	1
17.5	Law																	-	0	0	0	1	1	1	1
17.5	Dent																		-	0	0	1	1	1	1
19.5	F.Doc																			-	0	0	0	1	1
19.5	Drug																				-	0	0	1	1
21.5	Hos																					-	0	0	1
21.5	Bank																						-	0	1
23.5	Meat																							-	0
23.5	Groc																								-

but a more diffuse spatial pattern of provision of other items. This is borne out by consideration of the results of the rank-sum test (Table 5.7): medical specialist exceeds all other items; and large groups of items are absent, the largest being a four-member group comprised of children's clothes, television, watch and jewellery. Notably, travel for women's coat exceeds that for men's coat but there is no difference in travel distances for women's and men's shoes.

The general impression of similar patterns being represented in Figure 5.6 and Table 5.7 is reinforced by a value of $p = +0.99$ for the two rank-orderings of items based on extra-nucleation means.

Differences in mean distances between the

TABLE 5.8

COMPARISON OF SELECTED VALUES (in miles)

	Lakehead	Winnipeg
Highest extra-nucleation $\bar{x}$	102.8	175.5
Lowest extra-nucleation $\bar{x}$	47.6	19.1
Range	55.2	156.4
Highest travel $\bar{x}$	77.2	149.9
Lowest travel $\bar{x}$	17.0	3.5
Range	60.2	146.4
Highest true $\bar{x}$	77.2	149.9
Lowest true $\bar{x}$	16.3	3.5
Range	60.9	146.4
Maximum catalogue reducing effect	4.2	9.4

two systems are summarised in Table 5.8, where the higher maxima and lower minima of the Winnipeg system are readily apparent. The higher maxima may be ascribed to the lack of fifth order centres in the Winnipeg system[1] and the need to obtain fifth order items from Winnipeg, and to the lower number of third order centres in the Winnipeg system. No explanation of the Lakehead system's higher minima may be advanced here save that the abundance of third order centres and the presence of fifth order centres in the Lakehead system may encourage consumers to patronise higher order centres for lower order goods on multi-purpose shopping trips. Further, it is shown subsequently in this chapter (in the discussion) that the general use of catalogues in the Winnipeg system is significantly greater in the Lakehead system, which might partially explain the greater distance-reducing effect in the Winnipeg system (Table 5.8).

Application of Spearman's test for the rank-order coefficient of correlation to the two rank-orders of items contained in Tables 5.6 and 5.7 yields a significantly high value, $p = + 0.84$. This positive correlation obscures wide differences in the ranks of individual items: car (21st tied, Lakehead system; 3rd, Winnipeg system); meat (7th Lakehead system; 23rd, Winnipeg system); and refrigerator (21st tied, Lakehead system; 7.5 tied, Winnipeg system). These

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[1] Assuming Winnipeg is of a higher order than Port Arthur or Fort William.

differences underscore the different structures of the two hierarchies of service centres and consumers' utilisation of them.

STRUCTURE OF CONSUMER BEHAVIOUR

Whereas the preceding description and analysis of consumer travel distances is based on all the nucleated settlements surveyed in Northwestern Ontario, this analysis of the structure of consumer behaviour is restricted mainly to twenty-two nucleations (those involved in the aggregate analysis in Chapter 3): thirteen second and higher order nucleations in the Lakehead system and nine second and higher order nucleations in the Winnipeg system. Firstly, this analysis distinguishes amongst home-settlement purchases, extra-settlement purchases and catalogue purchases and, for first-order nucleations, data on home-settlement purchases and purchases made in settlements other than those of a settlement set (Chapter 2) are both entered under "other"; therefore, it is impossible to distinguish between home-settlement purchases and "other" for these places. Secondly, the nucleations omitted are small, the actual number of households surveyed at each place is small and any inference about the spatial patterns of consumer behaviour for each place (in the next section of this chapter) would be subject to large errors. Thirdly, because of the distribution of settlements within Northwestern Ontario, clear cartographic representation of

spatial behaviour would be impossible if all nucleations were included. The omission of these smaller nucleations does mean that investigation of relationship between structural and spatial patterns of consumer behaviour and consumer travel distances is difficult but nine hundred and seventy-three respondents are dealt with here, compared with 1,183 respondents dealt with in the distance analysis.

The structure of consumer behaviour for the two systems is summarised in Appendix 16, where information on home-settlement patronisation (HS), patronisation involving travel (T) and catalogue purchases (C) is presented for twenty-four items, both most buy and last buy behaviour. Although there are differences between the sample values for last buy and most buy behaviour, application of the two-tailed chi-square test reveals that no significant differences exist, at the level of each system, in the whole populations from which the two sample populations have been drawn. Most buy and last buy behaviour in respect of women's coat (Winnipeg system) may be cited as an example. The two distributions are as follows (percentages in parentheses):

	HS	T	C
Most buy	$222_{(58.0)}$	$129_{(33.7)}$	$32_{(8.3)}$
Last buy	$191_{(49.6)}$	$145_{(37.7)}$	$49_{(12.7)}$

Application of the chi-square test yields a value, $X^2 = 4.16$ (2df, 0.05), whereas $X^2 = 5.99$ is the critical value for assertion of difference.

The level of catalogue purchases in the Lakehead system ranges from 6.2 per cent (men's shoes) to 13.2 per cent (children's clothes) for apparel items and is below 5.1 per cent for heavy consumer durables such as television or furniture. A similar structure exists in the Winnipeg system where catalogue purchases of apparel range from 5.6 per cent (men's work clothes) to 15.4 per cent (children's clothing) and catalogue purchases for consumer durables lie below 5.3 per cent. (It may be recalled that it is established earlier that catalogue purchases have little effect on mean travel distances.)

Catalogue purchases have been discounted in examining the structure of consumer behaviour in relation to home-settlement patronisation and the tendency to travel. Sample percentages of home-settlement patronisation for twenty four items are represented in Figure 5.7 (Lakehead system) and Figure 5.8 (Winnipeg system) where the ranges within which the true percentages fall, at the 0.05 level of confidence, are also represented.[1]

In both systems the level of home-settlement patronisation exceeds the level of patronisation involving travel, with the exception of medical specialist in the Winnipeg system where travel patronisation exceeds home-settlement patronisation. (There is no preference in the Lakehead system in respect of medical specialist). In the

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[1] Calculated by means of the standard error of the percentage; see Chapter 3.

Lakehead system home-town patronisation for services other than medical specialist spans a wider range than that for goods: whereas bank, groceries and meat occupy the 90-100 per cent band, the lowest range of good (car) occupies the 55-65 per cent band while the lowest ranges of services (lawyer and optometrist) occupy the 50-60 per cent band. In the Winnipeg system, services, other than medical specialist, span much the same total range as goods, from about 55 to 100 per cent. This highlights, again, the strong concentration of lawyers and optometrists in the fifth-order centres of the Lakehead system and the greater dispersion of these two professional services within the Winnipeg system.

In Chapter Three the service centres of Northwestern Ontario's two systems of service are assigned to grades. It is possible to consider the relative levels of home-town and out-of-town patronisation by grade, rather than for the systems as a whole.

The sample percentages of home-town and out-of-town purchases for three levels of the Lakehead system are set forth in Table 5.9, where significant differences (as determined by chi-square test) are marked by asterisk (*).

For the fifth order, purchases in the home-settlement of all twenty-four items exceed purchases involving travel. For the third order, purchases of seventeen items in the home settlements exceed purchases involving travel, purchases involving travel exceed home-settlement purchases in the cases of three items and for four items there are no significant

differences. Noticeably, purchases of the three items involving significantly greater travel are all professional services (medical specialist, lawyer and optometrist), which, compared to retail goods are in short supply in small settlements. Also, two of the goods for which no difference is indicated involve women's apparel (shoes and coat). For the second order, purchase involving travel (14 items) exceeds home-town purchases (3 items), while there are no significant differences for seven items. Noticeably, the three items with

TABLE 5.9

LAKEHEAD SYSTEM: CONSUMER BEHAVIOUR BY SERVICE CENTRE GRADE

	5th Grade		3rd Grade		2nd Grade	
Item	H.S.	T	H.S.	T	H.S.	T
MWC	94.7*	5.3	82.4*	17.6	60.3*	37.0
Ws	95.1*	4.9	51.8	48.2	34.6	65.4
Ms	94.8*	5.2	69.5*	30.5	39.6	60.4
Tgc	94.2*	5.6	61.3*	38.7	25.0	75.0*
Cc	95.2*	4.8	75.9*	24.1	37.5	62.5
Mc	94.6*	5.4	60.0*	40.0	20.7	79.3*
Wc	92.4*	7.6	47.9	52.1	13.7	86.3*
Drugs	99.6*	0.4	82.8*	17.2	40.2	59.8*
Groc	97.8*	2.2	97.4	2.6	54.8	45.2
Meat	97.8*	2.2	97.0*	3.0	54.7	45.3
T.V.	81.9*	18.1	74.6*	25.4	48.2	51.8
Refrig	84.9*	15.1	56.2*	43.8	31.5	68.5*
Fu	80.3*	19.7	52.6	47.4	28.2	71.8*
Wa	94.0*	6.0	74.5*	25.5	42.8	57.2
Jew	96.1*	3.9	65.1*	34.9	31.3	68.7*
Car	81.6*	18.4	51.7	48.3	5.5	94.5*
Fam.Doc.	96.0*	4.0	85.4*	14.6	60.7*	39.3
Med.Spec.	90.7*	9.3	9.8	90.2*	0.0	100.0*
Dentist	93.8*	6.2	74.8*	25.2	37.3	62.7*
Lawyer	92.3*	7.7	17.7	82.3*	0.0	100.0*
CI	88.3*	11.7	75.1*	24.9	43.5	56.5
Opt.	92.8*	7.2	22.1	77.9*	8.6	91.4*
Bank	98.1*	1.9	94.8*	5.2	75.0*	25.0
Hospital	97.8*	2.2	86.9*	13.1	10.3	89.7*

* Significantly higher percentage at 0.05 level.

significantly greater travel purchases and the four items with no significant difference in the third order are all represented in the items involving significantly greater travel purchases in the second order. In fact, only one good (men's work clothes) and two services (family doctor and bank) show significantly higher levels of home-town patronisation. Therefore, consumers in third and fifth order centres tend to rely on their home-settlements rather than to travel, while consumers in second order centres tend to rely on other centres more than they rely on their home-settlements. (It may be suggested that the same is also true for consumers in first order centres).

These aspects of the structure of consumer behaviour are remarkably similar in the Winnipeg system. In the fourth order, home-settlement patronisation is significantly greater than patronisation involving travel for all items, except medical specialist. In the third order, seventeen items involve significantly greater home-settlement purchases, three items more travel purchases and four items no difference. Similar to the Lakehead third order, the three travel items are medical specialist, lawyer and optometrist, while three of the four involving no difference are the same: women's coat, furniture and car. In the second order, only four items involve significantly greater home-settlement patronisation while fifteen items involve more travel purchases and four no difference. Again, the third order items involving greater travel purchases and no difference all appear in the second order list of items involving more travel. In this system,

also, it appears that residents of third and fourth order centres tend to rely more heavily on their home settlements for goods and services while consumers in second order centres tend to rely more heavily on travel. (Again, it may be suggested that residents of first order centres also tend to rely more heavily on travel).

TABLE 5.10

WINNIPEG SYSTEM: CONSUMER BEHAVIOUR BY SERVICE CENTRE GRADE

	4th Grade		3rd Grade		2nd Grade	
Item	H.S.	T	H.S.	T	H.S.	T
Mwc	89.4*	10.6	86.5*	13.5	39.6	60.4
Ws	81.3*	18.7	84.8*	15.2	14.8	85.2*
Ms	86.0*	14.0	92.4*	7.6	26.4	73.6*
Tgc	68.1*	31.9	67.8*	32.2	12.0	88.0*
Cc	85.4*	14.6	76.6*	23.4	38.9	61.1
Mc	84.3*	15.7	67.2*	32.8	17.0	83.0*
Wc	75.8*	24.2	56.7	43.3	11.8	88.2*
Drugs	95.7*	4.3	96.4*	5.6	52.4	47.6
Groc.	98.2*	1.8	96.5*	3.5	79.4*	20.6
Meat	98.9*	1.1	96.4*	5.6	80.4*	19.6
T.V.	88.3*	11.7	76.1*	23.9	44.7	55.3
Refrig.	88.4*	11.6	69.6*	30.4	30.9	69.1*
Fu	83.2*	16.8	52.9	47.1	18.2	81.8*
Wa	86.3*	13.7	81.3*	18.7	27.1	72.9*
Jew	90.2*	9.8	77.6*	22.4	26.5	73.5*
Car	80.4*	19.6	48.3	51.7	11.6	88.4*
Fam.Doc.	95.0*	5.0	84.0*	16.0	77.8*	22.2
Med.Spec.	27.0	73.0*	23.1	76.9*	7.7	92.3*
Dentist	91.8*	8.2	53.4	46.6	25.0	75.0*
Lawyer	96.6*	4.4	27.6	72.4*	0.0	100.0*
C.I.	89.3*	10.7	84.6	15.4	45.3	54.7
Opt.	83.9*	16.1	32.8	67.2*	2.0	98.0*
Bank	99.3*	0.7	97.5*	2.5	83.6*	16.4
Hos.	94.3*	5.7	97.1*	2.9	38.7	61.3*

* Significantly higher percentages at 0.05 level.

SPATIAL BEHAVIOUR OF CONSUMERS

The examination of travel distances and the structure of consumer behaviour reveals differences amongst items and amongst orders of service centre. In Chapter Three, moreover, it is shown that differences exist within orders. Up to this point, additionally, the focus has been on levels of home-settlement patronisation and places visited have not been examined. The spatial behaviour of consumers in Northwestern Ontario is examined in detail for eight items: medical specialist, women's coat, lawyer, women's shoes, men's shoes, dentist, groceries and bank. (The date on which Figures 5.9 - 5.16 are based are set out in Appendix 17).

Major Settlements[1]

(1) Medical Specialist

This item is first-ranked, in terms of travel distance, for the whole of Northwestern Ontario (Table 5.5) as it is for the Rainy River and Lakehead dispersed populations (Chapter 4); and, although it is first-ranked in the Winnipeg system (Table 5.7), in the Lakehead system it is tied for first rank with optometrist and lawyer (Table 5.6). The structure of

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[1] For purposes of analysis and cartographic representation the settlement nucleations of Northwestern Ontario have been divided into two classes, major and minor. The major settlements are those nucleations, of the second order and higher, occurring in primary settlement sets and yielding samples large enough for the formation of meaningful inferences.

consumer behaviour in the two systems is similar and is as follows:

	Home-Town	Travel
Lakehead system	46.1%	53.9%
Winnipeg system	23.3%	76.8%

This is the only item which in aggregate displays a tendency for travel to exceed home-settlement provision and in only the fifth order does home-settlement patronisation exceed travel.

In the Lakehead system, consumers report obtaining medical specialist services at only four places other than at either Port Arthur and Fort William (Figure 5.9[1]). At Atikokan the sample percentage (35%) is high enough to suggest that medical specialist services are in fact offered there but, otherwise, the sample percentages are low enough to suggest that the respondents erred. Over ninety-five per cent of travel from the centres comprising the Lakehead system is focused on Port Arthur and Fort William, with the balance being

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[1] The construction of Figure 5.9 and Figures 5.10 - 5.16 presented considerable problems. The writer experimented with showing actual respondent trips (as in Chapter 4) but the scale-range proved too great. Thus the status of service centres is shown by variously-sized circles (status may be checked in Figure 3.11), percentage use of home-town is shown by solid black shading, percentage use of catalogues by stippling, and percentage of population travelling by thickness of diagonal lines. All percentages are based on the total number of respondents reporting obtaining an item by some means or other and not in the total number of respondents at a place; that is, respondents reporting an item inapplicable are excluded.

supplied by travel from Atikokan to Fort Frances and Winnipeg. (Indeed, the sample percentages for Atikokan do not allow its assignment to either system (Table 5.4). With the exception of travel from Nakina to Geraldton all travel within the Lakehead system is from second and third order centres to the Lakehead cities. It may be suggested that the Nakina respondents confused general medical attention received at Geraldton with specialist medical attention, because no Geraldton respondents report receiving the latter in their own town of residence.

Although there is no significant difference in Port Arthur and Fort William consumers' preference for the alternate centre (Table 5.11), consumer travel in aggregate over the Lakehead system exhibits a significant preference for Port Arthur (Table 5.12); and travel from all third order centres (except Schreiber, no preference) shows a significant preference for Port Arthur; and travel from the two second order centres (Longlac and Beardmore) with samples large enough for the performance of the chi-square test exhibits the same significant preference.

It may be recalled that under the referral system consumers do not really have a preference in seeking specialist medical services; but the greater number of hospital beds in Port Arthur (459, compared with Fort William's 373, Table 5.2) and the greater number of physicians there (69 compared with Fort William's 54, Chapter 3) at least increases the chances of referral to Port Arthur.

In the Winnipeg system no class of service centre is used by its own residents to the extent that home-town patronisation significantly exceeds travel (Table 5.10). In the three fourth order centres home-town patronisation ranges from twenty-four per cent (Fort Frances) to thirty-five per cent (Dryden), but at the third order centre of Red Lake over fifty per cent of the sample reports receiving medical specialist services there. This may in fact be the case, but it may also be the case that the distance between Red Lake and Winnipeg discourages utilisation of Winnipeg and encourages the use of what medical attention is available locally. These four centres apart, reported use of home-settlements is very low (under 10%) or absent and the bulk of the travel (93%) is to Winnipeg; although there is an example of inter-fourth order centre travel (Dryden to Kenora) and there are instances of inter-order travel (Balmertown to Red Lake and Keewatin to Kenora).

Travel for this item, involving the highest overall distances, reveals the maximum reach of Winnipeg and the Lakehead cities within Northwestern Ontario and the clear alignment of the major settlements into the two systems; with the exception of Atikokan already noted.

(2) Women's Coat

In terms of distance travelled, women's coat is tied in the third rank for the whole of Northwestern Ontario and is

the highest ranked good (Table 5.5); and, although it is tied in the seventh rank in the Lakehead system (Table 5.6), it is the second-ranked item and highest-ranked good in the Winnipeg system (Table 5.7). There is no significant difference in the structure of consumer behaviour between the two systems:

	Home-Town	Travel	Cat.
Lakehead system	61.1%	29.2%	8.7%
Winnipeg system	58.0%	33.7%	8.3%

In the Lakehead system, although there is an aggregate preference for use of home-settlement, only consumers resident in fifth order centres display it; there is neither preference for home-settlement patronisation nor travel in third order centres, and there is a preference for travel in second order centres (Table 5.9). At the level of individual centres, the level of home-town patronisation ranges from 96.5 per cent (Port Arthur) to nought per cent (Nakina). It may be recalled that, considering fifth and third order centres together, between-order variation exceeds within-order variation for this item (Table 3.5) but that, nevertheless, Port Arthur significantly exceeds Fort William and that Atikokan, Geraldton and Schreiber exceed other third order centres in level of home-town patronisation (Figure 3.7). In the third order, however, home-town patronisation significantly exceeds travel only at Atikokan. In Marathon, Nipigon, Red Rock and Beardmore, travel significantly exceeds home-town patronisation; but if catalogue purchases are added to the latter, there is no difference in levels of travel and non-travel purchases at

Marathon and non-travel purchases exceed travel purchases at Manitouwadge. Thus catalogue purchases, which seem to have little significant effect in aggregate, can alter the structure of consumer behaviour at the level of individual settlements. Their role, also, is most noticeable at Nakina on the periphery of the Lakehead system (Figure 5.10).

Ninety-two per cent of the travel by the system's consumers is to the Lakehead and there is a clear emphasis on Port Arthur (Figure 5.10). Fort William residents show a significant comparative preference for Port Arthur (Table 5.11) and consumer travel in aggregate exhibits the same significant preference (Table 5.12). At the level of individual settlements, Nipigon, Red Rock, Geraldton and Marathon all exhibit this preference. No centre shows a significant preference for Fort William. Short-distance travel is represented by slight movement from Terrace Bay to Schreiber, from Red Rock to Nipigon and from Nakina and Longlac to Geraldton.

In the Winnipeg system, the aggregate preference for home-town patronisation over travel is maintained only by the fourth order, there being no significant preference in the third order and a significant preference for travel in the second order (Table 5.10). At the level of the individual settlement, home-town patronisation ranges from a high of seventy-five per cent (Dryden) to a low of thirteen per cent (Nakina), but it may be recalled that the fourth and third orders exhibit no within-order variation (Table 3.8) and that the pattern of home-town patronisation approaches discrete hierarchical structuring (Figure 3.8).

Seventy-one per cent of the system's travel is to Winnipeg (Figure 5.10) and there are notable instances of short-distance travel: from Keewatin to Kenora and from Balmertown to Red Lake. Generally, travel within this sector of the study area is from lower-ranked centres to higher-ranked centres with the exception of very slight inter-fourth order travel (Dryden to Kenora) and light travel from a fourth order centre to third order centre (Dryden to Sioux Lookout). The pattern of travel behaviour seems to suggest three sub-systems within a system focused on Winnipeg: Fort Frances - Emo - Rainy River; Keewatin - Kenora - Dryden - Sioux Lookout; and Red Lake - Balmertown. Although north-south routes exist, they are probably not direct enough nor is the array of choice at the destination wide enough to justify a shorter north-south journey in lieu of the longer journey to Winnipeg.

In terms of home-town and travel patronage, centres follow the pattern of their ranks (Table 5.10). Addition of catalogue purchases to home-town patronage affects only one centre significantly: Red Lake consumers are converted from no preference to a significant preference for non-travel. Perhaps this is due to the distance between Red Lake and any fourth order centre or Winnipeg, which is greater than that between other third order centres and centres of higher rank.

The general pattern of travel behaviour shown in Figure 5.10 corresponds closely to that shown in Figure 5.9, except that there is less travel *in toto* to the Lakehead and Winnipeg and more travel amongst lower order centres.

(4) Lawyer

In terms of travel distance for the whole of North-western Ontario (Table 5.5), this item is tied in the third rank with the good examined above (women's coat) and another professional service (optometrist). This high overall ranking must stem from the tie in first rank in the Lakehead system (Table 5.6), because this item is tied at 17.5 in the Winnipeg system. Not only is the level of home-town patronisation in the Winnipeg system significantly higher than in the Lakehead system, but the percentage use of Winnipeg is lower than that of Lakehead. The gross structuring of consumer behaviour is as follows:

	Home-Town	Travel
Lakehead system	56.0%	44.0%
Winnipeg system	75.4%	24.6%

In only the fifth order in the Lakehead system is there a significant home-town patronisation preference; in the other two orders there is a travel preference (Table 5.9). Indeed, the survey of service provision revealed no lawyers practising on a full-time basis in any centres other than Port Arthur, Fort William and Atikokan. Similarly, in the Winnipeg system only the fourth order reveals significant preference for home-town patronisation, while second and third orders display a travel preference (Table 5.10). Again, the survey of service provision revealed full-time, practising lawyers in only Kenora, Dryden and Fort Frances. As Figure 5.12

shows, however, respondents report obtaining lawyers' services in more centres than those named above.[1] The writer knows that some Lakehead-based lawyers travel out to centres of the Lakehead system to advise clients unable to travel, to inspect property involved in sale or transfer and to represent clients in the Thunder Bay (Territorial) District Court. Also, employees of major companies (at Terrace Bay, Marathon, and Red Lake, for example) may have legal and quasi-legal transactions processed by lawyers employed by the companies. Thus there is no necessary discrepancy between reported receipt of lawyers' services and absence of lawyers' establishments.

In view of the amount of travel to the Lakehead from the centres to the east of it, it is surprising that no lawyers practise in these centres. It may be that the population threshold at any one centre is insufficient for a full-time legal establishment, but short-distance travel amongst centres could conceivably contribute to the formation of a threshold. It is likely, however, that preferences on the part of the supply factor outweigh the demand factor: lawyers seem to prefer to live in close contact with one another in the salubrious surroundings of the Lakehead, where sittings of the Ontario Supreme Court are also held, rather than to face a one-man practice in a small town.

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[1] A similar discrepancy is noted for the Rainy River dispersed population in respect of the centres of Emo and Rainy River (Chapter 4).

The pattern of spatial behaviour (Figure 5.11) emphasises Port Arthur. While there is no Port Arthur-Fort William preference for the alternate centre (Table 5.11), there is an aggregate preference for Port Arthur within the whole system (Table 5.12). Geraldton, Nipigon, Marathon, Manitouwadge and Red Rock residents show a significant preference for Port Arthur over Fort William, while no centre at all shows a preference for Fort William.

Whereas over ninety-five per cent of those travelling in the Lakehead system journey to the Lakehead, only twelve per cent of the sample travelling in the Winnipeg system report trips to Winnipeg on a regular basis (Figure 5.11). Much more impressive is the volume of travel within the Northwestern Ontario sector of the Winnipeg system, with Rainy River heavily dependent on Fort Frances, Keewatin on Kenora, and Balmertown and Sioux Lookout on Dryden. The low percentage of travel to Winnipeg is perhaps explained by differences between Ontario and Manitoba law; and use of centres in the United States is markedly absent. It is noteworthy that the three sub-systems of movement with east-west orientation, identified for women's coat, are replaced by a more integrated system involving north-to-south movements.

Despite distance differences and differences in the structure of consumee behaviour, the general spatial patterns of the two systems remain distinct.

(7) Women's Shoes

This consumer good is tied in the seventh rank in terms of travel distances for the whole of the study area (Table 5.5) and is tied in seventh rank in the Lakehead system (Table 5.6), closely corresponding to the ninth rank in the Winnipeg system (Table 5.7). These distance similarities are repeated in the structuring of consumer behaviour, which is as follows:

	Home-Town	Travel	Cat.
Lakehead system	65.3%	23.9%	10.8%
Winnipeg system	64.0%	24.7%	11.3%

In the Lakehead system the fifth order displays a preference for home-town patronisation, the third order no preference and the second order a travel preference (Table 5.9). Despite considerable variation in the level of home-town patronisation in the third order, ranging from sixty-five per cent at Atikokan to twelve per cent at Nipïgon, variation between the third and fifth orders exceeds internal variations (Table 3.5 and Figure 3.7). The pattern of variation in the third and second orders is difficult to explain. Residents of Nipigon and Red Rock buy more by travelling, mainly to the Lakehead, than they do in their home settlements. A low level of home-town provision might be ascribed to consumers' readiness to travel to the Lakehead, only some sixty miles away, but Marathon residents located some two hundred miles from the Lakehead also show a preference to travel rather than purchase in their home-town. On the other hand, Manitouwadge and

Atikokan residents buy more at home than they travel for and distance may be significant here. At Schreiber, Terrace Bay, Geraldton and Longlac there are no significant preferences. If catalogue purchases are added to home-town purchases and the combined group considered as a non-travel group, however, the relationships described above are altered: at Schreiber and Geraldton there is a significant preference for non-travel; at Marathon there is no preference and nor is there at Beardmore and Nakina. Nipigon and Red Rock residents, however, still display travel preferences. Accordingly, it would seem that catalogues are effective in altering the structure of consumer behaviour at distances of over sixty miles, as far as this good is concerned.

Within the system, there is some short-distance travel, (Figure 5.12), mainly from second to third order centres, but the bulk of the travel is to the Lakehead (94%). Fort William residents show a significant preference for Port Arthur (Table 5.11), as does the system as a whole (Table 5.12). In the second order, Geraldton, Nipigon, Terrace Bay and Marathon show a significant preference for Port Arthur, as does the second order centre of Red Rock. No second or third order centres show a significant preference for Fort William.

Although the Winnipeg system's structure of consumer behaviour is similar to the Lakehead's in overall terms, its third order shows a preference for home-town purchase, in contrast to the Lakehead's third order no preference (Tables 5.9 and 5.10); and, despite a within-order difference in excess

of between-order difference (Tables 3.6 and 3.8), all centres in the fourth and third orders conform to the generalisations made above about their orders. Addition of catalogue purchases to home-town purchases intensifies the fourth and third order non-travel preference and does not affect the travel preference of second order centres.

Travel to Winnipeg accounts for only fifty-one per cent of travel within the system and there is a greater amount of short-distance travel than is the case in the Lakehead system.

Again, the reach of Winnipeg and the Lakehead in Northwestern Ontario is similar to that for preceding items.

(13) Men's Shoes

Considering distances for the whole of the study area, this item is ranked in thirteenth place, well below women's shoes (Table 5.5); and it is ranked in ninth place in the Lakehead system (Table 5.6) and in fourteenth place in the Winnipeg system (Table 5.7).

Although there is this difference in rank between the two systems, there is no significant difference in the gross structure of consumer behaviour, which is as follows:

	Home-Town	Travel	Cat.
Lakehead system	74.0%	19.8%	6.2%
Winnipeg system	74.4%	19.7%	5.9%

In the Lakehead system the gross preference for patronisation of home-town is repeated by the fifth and third

orders, but there is no preference in the second order. At the level of the individual centre the sample percentages of home-town patronisation range from over ninety (Port Arthur and Fort William) to nought (Nakina). All the same, between-order variation exceeds within-order variation, considering the third and fifth orders (Table 3.5 and Figure 3.7).

Most travel in the system focuses on the Lakehead (88%) and there is a preference for Port Arthur over Fort William. Whereas neither Port Arthur nor Fort William show a preference for the alternate centre (Table 5.11), the centres in aggregate show a preference for Port Arthur (Table 5.12). Moreover, Nipigon, Red Rock and Marathon display a significant preference for Port Arthur, while no individual centre shows a preference for Fort William (Figure 5.13).

The addition of catalogue purchases to home-settlement purchases alters no relationships significantly. Atikokan, Geraldton, Schreiber and Manitouwadge residents prefer to patronise their home-settlements rather than to travel, while travel is preferred at Red Rock.

The structure of consumer behaviour in the Winnipeg system varies from that in the Lakehead system in that the Winnipeg second order diplays a significant preference for travel. All centres in the fourth and third orders display a home-settlement patronisation preference whereas only Keewatin shows a significant preference for travel. Addition of catalogue purchases to home-town purchases alters no relationships significantly. Only forty-two per cent of all

travel within the system is to Winnipeg and much of the travel is made up of short distance trips: Keewatin to Kenora, Balmertown to Red Lake and Emo to Fort Frances. Noticeably, Sioux Lookout has the highest level of home-town patronisation (97%) and has no sample value linking it with the Winnipeg system; indeed a link with the Lakehead system is indicated.

Women's and Men's Shoes Compared

The two items do not vary significantly in either system in the percentage of catalogue purchases. The two distributions do vary, in both systems, in that the percentage of home-town men's shoes purchases is significantly higher than that for women's shoes. This, added to the higher percentages held by the Lakehead and Winnipeg in their systems' total travel for women's shoes, accounts for the higher distance rankings of women's shoes.

Men numerically exceed women in Northwestern Ontario and this, together with the stress on maleness in frontier society, may account for a greater dispersal of provision of men's shoes and consequently less travel. It may be suggested, also, that men are less sophisticated than women in their need for a wide array of choice and that therefore their shoe purchases can be made from more restricted arrays which are more widely-dispersed than the wider arrays of women's shoes.

(17) Dentist

This item exceeds only one other item (bank) in terms of distances travelled in Northwestern Ontario and as such is tied in the 17.5 rank along with five other items (Table 5.5). In the Lakehead system it is tied in the fourteenth rank along with eight other items and there it exceeds three items (Table 5.6); while in the Winnipeg system it shares the 17.5 rank with one other item and exceeds four items.

In both systems there is a significant preference for home-town patronisation over travel and the level of home-town patronisation in the Lakehead system is significantly higher than the level of home-town patronisation in the Winnipeg system:

	Home-Town	Travel
Lakehead system	79.3%	20.7%
Winnipeg system	71.0%	29.0%

These gross differences between the two systems are reflected by differences amongst the orders. The fifth and third orders in the Lakehead system show a significant preference for home-town patronisation, while the second order exhibits a significant preference for travel; the fourth order in the Winnipeg system shows a significant preference for home-town patronisation, the second for travel, but the third exhibits no significant preference.

In the Lakehead system all third order and higher centres show some level of home-town patronisation, as do the

second order centres of Longlac and Red Rock. Of all these centres only Nipigon and Red Rock display a significant preference for travel; and both of these exhibit a preference for Port Arthur over Fort William. No other individual centre, not even Fort William, shows this preference for Port Arthur; although the preference is present in aggregate (Table 5.12).

It is conjectural whether travel from Nipigon and Red Rock to the Lakehead is occasioned by underprovision at these centres resulting from shortage of dentists or whether the proximity of these centres to the Lakehead has prevented more dentists from locating in them. The former is more likely to be the case, given the tendency for short-distance trips where these are feasible (Figure 5.14). Some Schreiber residents, for example, utilise Terrace Bay, rather than the Lakehead, and Nakina and Longlac residents utilise Geraldton. At the same time there is the apparent paradox of Terrace Bay and Geraldton dentists failing to serve their own populations but accepting patients from other centres. A certain amount of travel to the Lakehead from centres with dentists is to be expected, because certain dental operations -- such as removal of all teeth under an anaesthetic -- have to be performed in hospitals, usually by specialist dental surgeons. Also, in an area of overall dentist-shortage, consumers will perhaps continue their treatment with the same dentist even although a change in residence causes considerable travel.

In the Winnipeg system all fourth order centres have a high level of home-town patronisation, but one third order

centre (Rainy River) has none and two second order centres (Emo and Keewatin) have none. There is a slight amount of long-distance travel to Winnipeg and, as with the Lakehead system, it is felt that this is connected with securing specialist dental treatment rather than compensating for a shortage of dentists. Most travel tends to involve short distances and particularly telling is the heavy use by Rainy River of Baudette, in the United States, instead of Fort Frances (cf. Chapter 4).

The main outlines of the Winnipeg and Lakehead service areas appear to resemble the service areas already discussed but the amount of travel to the major focii is less, particularly in the Winnipeg system.

(18) Groceries

In terms of travel distances, groceries are tied in the 17.5 rank along with the preceding item (dentist) and four other items (Table 5.5). Tied in the fourteenth rank and exceeding three other items in the Lakehead system (Table 5.6), it is the twenty-fourth and last-ranked item in the Winnipeg system, where it exceeds no other item (Table 5.7).

The structure of consumer behaviour in both systems reveals a strong and significant preference for home-town patronisation and the systems do not differ significantly in its relative strength:

	Home-Town	Travel
Lakehead system	92.9%	7.1%
Winnipeg system	95.1%	4.9%

There is enough movement in the east of the study area still to refer to a Lakehead system. Indeed, while the fifth and third orders reveal a distinct and significant preference for home-settlement patronisation (Table 5.9), the second order shows no significant preference. In this instance, however, rather than second order centres focusing primarily on the Lakehead with subsidiary or no focusing on other levels of centre, they mainly focus on nearby third order centres; Nakina and Longlac on Geraldton; and Beardmore and Red Rock on Nipigon (Figure 5.15).

Another feature not yet encountered in the way in which a variety of centres are patronised by residents of some settlements. Thus, Beardmore residents patronise Geraldton, Nipigon and Port Arthur, in addition to Beardmore itself; and Red Rock residents patronise Nipigon, Port Arthur and Fort William, in addition to Red Rock itself.

It seems likely that long-distance trips, such as Manitouwadge to Port Arthur and Atikokan to Winnipeg, do not represent regular shopping-grips solely for groceries; rather, they probably represent groceries purchased on trips undertaken for other retail goods or for business or social reasons.

Levels of home-settlement patronisation are so high and movement to Winnipeg so light, that it is probably inaccurate to refer to a Winnipeg system in the west of the study area. All three orders show a preference for home-settlement patronisation (Table 5.10). Rather, it appears as if there are

four subsystems: Fort Frances - Emo - Rainy River, in the south; Balmertown - Red Lake, in the north; and between these, Keewatin - Kenora and Dryden - Sioux Lookout.

In respect of grocery purchases, the existence of a Lakehead system is much more convincing than the existence of a Winnipeg system.

(24) Bank

Travel for this item in Northwestern Ontario is so light as to place it in the lowest possible rank, tied with three other items (Table 5.5), although it is not in the lowest rank in either of the two systems (Tables 5.6 and 5.7). There is no significant difference between the two systems in the structure of consumer behaviour, which show a strong preference for home-town patronisation:

	Home-Town	Travel
Lakehead system	93.1%	8.9%
Winnipeg system	96.6%	3.4%

Moreover, all orders in both systems exhibit this preference (Tables 5.9 and 5.10).

In the Lakehead system there are three instances of complete home-town patronisation (Schreiber, Manitouwadge and Atikokan) and generally the level of home-town patronisation is high, except for Nakina where there is no bank. Accordingly, apart from Nakina's heavy dependence on Geraldton, travel is slight (Figure 5.16). Some of this travel represents

utilisation of a bank in the centre of work-place rather than the centre of residence: for examples, Geraldton and Longlac, and Red Rock and Nipigon.

As with groceries, it is difficult to assess the travel in the western part of the study area as constituting the basis of a system. There is only one instance of movement to Winnipeg (from Rainy River) and there appear to be four sub-systems: Fort Frances - Emo - Rainy River; Keewatin - Kenora - Dryden; Sioux Lookout; and Red Lake - Balmertown.

In respect of this item, then, there is a weak Lakehead system and four sub-systems in the western part of the study area.

Minor Settlements

Because the sizes of the samples obtained from Northwestern Ontario's minor settlements are small, it is not possible to infer patterns of spatial behaviour at the level of the individual settlement. Further, because the method of data-recording does not allow precise computation of the level of home-settlement utilisation, analysis of the structure of consumer behaviour and its spatial expression cannot be performed in ways directly comparable to that for the major settlements. Some analysis of the minor settlements' spatial patterns of consumer behaviour is required, however, to seek justification for the term service centre and corroboration of the major lineaments of consumer circulation outlined immediately above. Due to the shortcomings of the data, spatial patterns are presented for only two, arbitrarily-selected goods: women's coat and groceries.

(2) Women's Coat

The patterns of extra-nucleation travel for this good are portrayed in Figure 5.17,[1] where a single line represents one respondent's reported regular behaviour and thicker lines a greater number than one (see key). Also, because of the concentration of minor settlements into a few areas, it was found necessary to distort the settlement map by increasing the map distance between some of the settlements: for example, the spacing amongst Rosslyn, Vicker's Heights, Kakabeka Falls, Murillo and Jumbo Gardens, at the Lakehead; and amongst Gunne, Eagle River, Minnitaki, Vermilion Bay, and Oxdrift, to the immediate west of Dryden.[2]

The Lakehead system is defined by travel to Port Arthur and Fort William from Upsala in the west, from Armstrong in the north, and from Macdiarmid and Rossport in the east. Although there are isolated instances of trips from Madsen and Ignace, the general travel patterns of these two settlements do not place them within the Lakehead system. Within the system the prime focus is on Port Arthur and Fort William, particularly on Port Arthur, with small amounts of travel to Nipigon and Schreiber. In the extreme

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1 Abbreviations in Figures 5.17 and 5.18 denote settlements, as follows: A Armstrong, B Barclay, Bc Borup's Corners, C Cochenour, CF Cameron Falls, De Devlin, Di Dinorwic, Do Dorion, EF Ear Falls, ER Eagle River, G Gunne (Waldhof), HB Heron Bay, HBS Heron Bay South, Ig Ignace, J Jellicoe, JG Jumbo Gardens, JM Jaffray-Melick, KF Kakabeka Falls, LV La Vallee, Ma Madsen, Mc Macdiarmid, McI McKenzie Island, Mi Minnitaki, Mu Murillo, NF Nestor Falls, Ox Oxdrift, P Pinewood, Ra Raith, Re Reddit, RL Rabbit Lake, Rp Rossport, Ry Rosslyn, Sl Sleeman, SN Sioux Narrows, St Stratton, Up Upsala, VB Vermilion Bay, VH Vicker's Heights.

2 The same applies to Figure 5.18.

east, the concentration of Heron Bay and Heron Bay South on Marathon would seem to place the first two named outside of the Lakehead system but Marathon itself is earlier shown to be part of the Lakehead system. Heron Bay and Heron Bay South, therefore, may also be considered part of the Lakehead system.

The Winnipeg system is composed of four sub-systems of travel patterns, which are bound together by travel from each to Winnipeg rather than by travel amongst themselves: in the north the Red Lake sub-system, which is focused on Red Lake itself; in the south, the Fort Frances sub-system, focused on Fort Frances; and between these two, one sub-system focused on Dryden and another focused on Kenora.

(18) Groceries

The patterns of travel for this good are represented in Figure 5.18, which contrasts with the preceding figure in that the amount of travel is less. It may be suggested that this is a result of greater levels of home-settlement provision and that many of the minor settlements act as service centres, at least for their own populations.

The Lakehead system is slightly less comprehensive than it is for women's coat, stretching from Kakabeka Falls, through Raith to Dorion. Nipigon, Beardmore, Geraldton, Schreiber, and Marathon are all focii of travel and, as these are previously included within the Lakehead system, thus that system is indirectly more extensive, in this instance, than the patterns shown in Figure 5.18 would seem to suggest.

In the west the unifying force of travel to Winnipeg is absent and the four sub-systems appear very distinctly. Re-alignments of individual settlements, in terms of this good are few. Ear Falls, linked to both the Kenora and Dryden sub-systems in terms of women's coat, is here linked to Red Lake; and Ignace, previously linked to the Dryden sub-system, is linked to the Kenora sub-system.

Port Arthur - Fort William Choice

In the analysis of the spatial patterns of consumer travel behaviour of the Lakehead dispersed population (Chapter 4), it is established that these consumers prefer Port Arthur to Fort William for three items: car, refrigerator and furniture. Moreover, the Lakehead dispersed population is contained within a range of thirty travel miles of both Port Arthur and Fort William. While for some of these consumers (those living in the area of overlap of the two cities' tributary areas) there is little to choose between either city, on a distance basis, for others, to visit the city farthest from them may involve adding one or two miles to their journey (about seven per cent).

For a consumer living in Port Arthur and shopping in Fort William (and vice-versa), his travel distance may be double the figure it would be if he patronised his city of residence. The survey of service provision suggests no difference between the two cities in equipment (Chapter 3) and in Chapter One the point is made that some residents refuse to travel to the other city. On the other hand, both cities contain former residents of the

other city and it might be expected that after moving between cities doctors and dentists would be retained even if shopping patterns for goods altered. Most travel outside of Port Arthur by Port Arthur residents and outside of Fort William by Fort William residents for goods and services involves use of the other city, and patronisation of the other city is expressed as a percentage of total purchases by residents of the home-city in Table 5.11. Application of the one-sided chi-square test to the data on which these percentages are based shows that nine of the differences are significant. In each case Fort William residents exhibit a level of use of Port Arthur significantly greater than Port Arthur residents' use of Fort William. All nine cases involve goods and three of the goods are those involved in the dispersed population's intrinsic preference for Port Arthur. It is, perhaps, noteworthy that Port Arthur is preferred for both items of women's apparel but not for the same two items of men's apparel, suggesting that women demand a greater array of choice than men and that this is provided in Port Arthur, probably in the two major department stores.

Over the whole of the system of service centres focused on the Lakehead, where travel distances to the Lakehead range up to over two hundred miles, the distance added to the total journey by travelling to the farther city is negligible. Manitouwadge residents, for example, travel 224 miles to Port Arthur and 232 miles to Fort William.

In the preceding section on spatial behaviour there is frequent reference to aggregate preference, by item, for Port Arthur and to individual centre preference, by item, for Port

TABLE 5.11

PORT ARTHUR AND FORT WILLIAM: DIFFERENTIAL PATRONISATION

Item	% P.A. consumers buying in F.W.	% F.W. consumers buying in P.A.
Men's work clothes	2.4	7.9*
Women's shoes	0.0	8.0*
Men's shoes	3.5	7.3
Teenage girls' clothes	1.4	9.8*
Children's clothes	0.0	10.6*
Men's coat	3.0	8.2
Women's coat	2.9	13.5*
Drugs	0.0	0.8
Groceries	0.7	4.1
Meat	1.3	3.3
Television	10.7	26.9*
Refrigerator	5.0	28.2*
Furniture	9.8	31.8*
Watch	4.8	6.5
Jewellery	4.7	2.9
Car	8.1	34.0*
Family Doctor	5.2	2.4
Medical Specialist	7.8	11.7
Dentist	6.2	6.1
Lawyer	5.6	10.2
Car Insurance	11.5	11.9
Optometrist	7.6	6.4
Bank	3.3	2.5
Hospital	2.0	2.5

* Significantly higher percentage at 0.05 level.

Arthur. Consumers travelling to Port Arthur and Fort William have been aggregated by item and percentage data are shown in Table 5.12. Except for two items (family doctor and bank), there is a significant preference for Port Arthur.[1]

TABLE 5.12

LAKEHEAD SYSTEM: DIFFERENTIAL PATRONISATION OF PORT ARTHUR AND FORT WILLIAM BY ITEM

Item	Travel to the Lakehead by Twelve Centres	
	% to Port Arthur	% to Fort William
Mwc	86.5*	13.5
Ws	88.8*	11.2
Ms	82.4*	17.6
Tgc	90.0*	10.0
Cc	90.2*	9.8
Mc	79.5*	20.5
Wc	87.0*	13.0
Drugs	75.0*	25.0
Groc.	90.5*	9.5
Meat	69.2*	30.8
T.V.	71.7*	28.3
Refrig.	85.7*	14.3
Fu	81.1*	18.9
Wa	79.2*	20.8
Jew.	74.4*	25.6
Car	76.9*	23.1
Fam.Doc.	52.4	47.6
Med.Spec.	79.8*	20.2
Dent.	71.3*	28.7
Law.	84.0*	16.0
Car Ins.	64.9*	35.1
Op.	82.8*	12.0
Bank	56.3	43.7
Hos.	63.6*	36.4

* Significantly higher percentage at 0.05 level.

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[1] The data on which Table 5.12 is based include travel between Port Arthur and Fort William. Subtraction of these figures does not alter the signficance of the results.

At the level of the individual settlement, preference for Port Arthur over Fort William is widespread. Data on each settlement's use of Port Arthur and Fort William for goods and services have been totalled and are expressed as percentages of those travelling to the Lakehead (Table 5.13).

TABLE 5.13

LAKEHEAD SYSTEM: DIFFERENTIAL PATRONISATION OF PORT ARTHUR AND FORT WILLIAM BY SETTLEMENT

	Goods		Services		Both	
	% PA	% FW	% PA	% FW	% PA	% FW
Atikokan	75.0*	25.0	76.7*	23.3	75.7*	24.3
Geraldton	90.5*	9.5	98.1*	1.9	94.5*	5.5
Nipigon	89.3*	10.7	84.9*	15.1	87.4*	12.6
Terrace Bay	72.6*	27.4	71.2*	18.8	72.1*	27.9
Schreiber	66.7*	33.3	46.7	53.3	55.1	44.9
Marathon	83.0*	17.0	87.6*	12.4	83.1*	16.9
Manitouwadge	79.7*	20.3	90.4*	9.6	84.5*	15.5
Longlac	80.6*	19.4	97.1*	2.9	97.1*	2.9
Nakina	70.8*	29.4	66.7*	33.3	69.6*	30.4
Red Rock	90.1*	9.9	76.1*	23.9	85.1*	14.9
Beardmore	94.5*	5.5	96.1*	3.9	95.3*	4.7

* Significantly higher percentage at 0.05 level.

A significantly higher percentage of each centre's population utilises Port Arthur; except for Schreiber (services) where there is no significant difference, but the lack of difference is small enough to produce no overall preference.

In attempting to account for this preference for Port Arthur, it is useful to note that ten of the eleven settlements listed in Table 5.13 are located to the east of the Lakehead and,

therefore, Port Arthur is the first of the two cities reached on journeys from those ten. It is noted earlier that the additional distance involved in continuing on to Fort William is negligible as a proportion of the total distance covered in reaching the Lakehead; but, equally, the relief felt in reaching Port Arthur after a long journey might be sufficient to cause most travellers to call a halt and obtain goods and services there. The location of Atikokan to the west of the Lakehead and with a preference for Port Arthur, might appear to destroy this explanation, but travellers from Atikokan have a choice between a shorter, more difficult route to Port Arthur (past Jumbo Gardens) and a longer, easier route to Fort William (through Kakabeka Falls).

Discussion

The findings, and analysis of them, relating to the consumer behaviour of Northwestern Ontario's nucleated population raise and clarify both methodological and substantive issues.

Three methodological issues are resolved. Firstly, respondents appeared to differentiate very clearly between use of Port Arthur and Fort William, both in terms of most buy and last buy; rarely did questions on place of purchase elicit the response "Lakehead" and require probing for either Port Arthur or Fort William. Secondly, the lack of significant variation in centres visited and in distances travelled, between last buy behaviour and most buy behaviour, suggests that either form of wording is appropriate in Northwestern Ontario, other frontier areas and also, perhaps, in non-frontier areas. Further, it

validates direct comparison of most buy data, where both types are available, with last buy data, where only this is available. Thirdly, it appears that the practice of inferring tributary areas from selected indices, such as newspaper circulation areas and hospital drainage areas, may provide an accurate general picture, but one incapable of revealing differential use in situations of tributary area overlap, such as prevails in the Lakehead system.

Two methodological problems are raised and clarified. Firstly, where there are a large number of nucleations in a research design, and particularly where it is anticipated that there will be heavy use of home-settlements, each nucleation should be provided with its own category for recording home-settlement purchases. The recording of home-settlement purchases under "other" resorted to in this study hampers analysis, although when the recording procedure was devised the writer was unaware of the high level of home-settlement purchases in the higher orders and did not at that stage intend to devise a home-town/out-of-town dichotomy for analytical purposes. An alternative might be to record purchases by order of centre rather than by actual centre but this procedure could not be adopted here as research into the structure of service provision and consumer behaviour was concurrently conducted. Secondly, the high level of home-settlement purchases and the consequent entry of zero distances converts an analytical problem made difficult by skewed distance distributions into an almost intractable situation. Some researchers, for example Ray (1967), in rejecting mean distances adopt tests based on standard deviations, but subjective scrutiny of means and standard deviations suggests that these are inadequate descriptors.

One other solution suggested to the writer is data-transformation but the writer is not sufficiently aware of its properties, particularly its limitations, to employ it here.

The substantive findings mainly concern tributary areas, orders of service centre and the role of catalogues.

Northwestern Ontario is shown to focus, in terms of consumer behaviour, on Winnipeg and on the Lakehead. The Lakehead system of service centres is shown to operate for items involving large amounts of travel and high mean travel distances, (medical specialist, for example) and also for items involving low amounts of travel and low mean travel distances (groceries for example). The Winnipeg system of service centres is shown to operate for the former items but it tends to break down into sub-systems for the latter items. This tends to hold true for both major settlements' and minor settlements' travel behaviour. Within these two major tributary areas certain service centres other than Winnipeg or the Lakehead cities have certainly developed service areas and perhaps tributary areas: notably Red Lake, Dryden, Kenora and Fort Frances in the Winnipeg system; and Geraldton and Nipigon in the Lakehead system.

In an unusual sub-division of Canada into a regional system based on the zones of influence of major metropolitan centres, Watson (1962) suggested, *inter alia*, that Northwestern Ontario fell within the spheres of influence of Winnipeg and Toronto. Although Watson's map is at a small scale the junction of the Winnipeg and Toronto zones of influence seems to correspond quite closely with the junction of the Winnipeg and Lakehead tributary areas indicated in Figures 3.11 and 5.9 (Watson, 1962, Figure 1, p. 147).

The reported use of "other" settlements for specific items was so low that it is not considered in the main body of this chapter. When this study was in the design stage, however, the writer supplemented the "other" categories for specific items by a general question on trips to major centres outside Northwestern Ontario, which it was felt that Northwestern Ontario residents might visit (question number 8, Appendix 5). Although the form of the question-wording tends to favour major centres close to Northwestern Ontario, such as Duluth-Superior, rather than those farther afield, such as Toronto, the results reveal that the Lakehead tributary area varies in the major centre with which it has strongest links and that Toronto's influence is not all-pervasive (Table 5.14). Whereas a significantly greater percentage of the system's population has made at least one trip outside of Northwestern Ontario to one of the major centres named (in question number 8) than has not, a significantly greater percentage has visited Duluth-Superior than has visited Toronto and there are no significant differences in the level of last visits to Duluth-Superior and Winnipeg on the one hand and to Winnipeg and Toronto on the other. It is true that most of the emphasis on Duluth-Superior is derived from Fort William and Port Arthur, but their populations constitute a major segment of the Lakehead system's total population. Moreover, a significantly higher percentage of the Winnipeg system's population (54.2) reports last visit to Winnipeg than that of the Lakehead system (10.6) reporting last visit to Toronto. Although the use of Duluth-Superior by Port Arthur and Fort William is higher than that reported by the

TABLE 5.14

LAKEHEAD SYSTEM: USE OF MAJOR CENTRES OUTWITH NORTHWESTERN ONTARIO

	Winnipeg	Toronto	Duluth-Superior	Minneapolis - St. Paul	Other	None
P.A.	15	10	43	14	9	154
F.W.	17	8	33	12	7	122
Atikokan	8	1	2	1	7	36
Geraldton	6	4	0	0	6	43
Nipigon	5	3	1	1	2	31
Schreiber	0	1	1	0	2	16
Manit.	2	8	0	0	12	37
Terr.Bay	3	7	0	0	10	31
Mara.	2	9	2	1	12	36
Longlac	0	3	1	0	0	17
Red Rock	5	4	1	0	2	29
Beard.	1	3	1	0	1	12
Nakina	2	0	1	0	0	12
Totals	66	61	86	29	70	264
(%)	(11.5)	(10.6)	(14.9)	(5.0)	(12.2)	(45.8)

Lakehead dispersed population (Chapter 4) the findings do tend to suggest that Port Arthur and Fort William represent a pinnacle of service provision and a focus for consumers, with little regular travel outside of the system. In other words the system is very nearly complete or self-contained. Most regular circulatory patterns occur within the frontier area of Northwestern Ontario

and this part of the Province of Ontario tends to turn in on itself, at least as far as obtaining goods and services is concerned.

Moreover, the Lakehead tributary area is shown to consist of the tributary areas of Port Arthur and Fort William, which are generally co-extensive in areal terms but with a greater intensity of focus on Port Arthur.

In his re-statement of the dispersed city hypothesis, Burton (1963) theorised that where a pattern of closely-spaced cities had developed, there might be a tendency for individual cities to offer distinctive goods and services not offered by others and for reciprocal consumer travel to occur amongst the cities. This does not appear to have occurred at the Lakehead, where there is a movement from Fort William to Port Arthur which is not matched by a movement from the latter to the former for other items. Nor has it occurred in the Red Lake area, where there is movement from first order centres to a second and a third order centre and from the second to the third order centre. There is, however, a suggestion of reciprocity between Shcreiber and Terrace Bay, with Schreiber providing some Terrace Bay residents with goods, such as drugs and cars, and Terrace Bay providing some Schreiber residents with dental and medical services.

The second substantive finding concerns the orders of service centre identified in Chapter Three. Although the home-town purchase component of consumer behaviour is in part used (Chapter Three) to confirm the allocation of service centres to

orders, the travel components of consumer behaviour are used in the present chapter to confirm those assignments. The patterns portrayed in Figures 5.9 - 5.16 are particularly valuable in resolving the allocation of Nakina, Red Rock, Longlac and Beardmore to an order lower than that containing Geraldton, Nipigon *et al.* Movement from Nakina and Longlac to Geraldton and from Beardmore and Red Rock generally outweighs movement in the reverse direction or has no counterpart. Moreover, the patterns of movement generally tend to confirm the assignment of service centres to their respective orders (cf. Ray, 1967, p. 143).

Although catalogue purchases within the two systems are remarkably similar at the level of individual items, it did not prove possible to measure the effect of catalogue purchases in altering levels of consumption of items, as is the case in Chapter Four, mainly because of small sample sizes. It is shown in this chapter, nonetheless, that catalogue purchases may be important in altering travel/non-travel preferences.

To assess the role of catalogues in general, within the context of respondents' shopping habits rather than within the context of specific items, respondents were questioned on their use of catalogues in the month immediately preceding their interview. In only two settlements in the Lakehead system was use of catalogues significantly greater than non-use of catalogues and this is balanced by two significantly greater levels of non-use (Table 5.15). The Lakehead system as a whole demonstrates no significant preference. The Winnipeg system as a whole does demonstrate a preference for use of catalogues, reflecting the

TABLE 5.15

NORTHWESTERN ONTARIO: RECENT USE OF CATALOGUES IN MAJOR SETTLEMENTS

	% using recently	% not using recently
Lakehead system		
Port Arthur	34.4	65.6*
Fort William	37.1	62.9*
Atkikokan	61.8	38.2
Geraldton	65.2	34.8
Terrace Bay	74.2*	25.8
Schreiber	37.5	62.5
Marathon	63.9*	36.1
Manitouwadge	56.8	43.2
Nipigon	60.0	40.0
Beardmore	66.6	33.4
Nakina	50.0	50.0
Red Rock	44.8	55.2
Longlac	35.3	64.7
Total $\overline{X}$	47.3	52.7
Winnipeg system		
Kenora	64.9*	35.1
Dryden	65.4*	34.6
Fort Frances	67.2*	32.8
Sioux Lookout	55.9	64.1
Red Lake	77.8*	22.2
Rainy River	50.0	50.0
Emo	46.2	53.8
Keewatin	76.7*	23.3
Balmertown	81.8*	18.2
Total $\overline{X}$	65.7*	34.3

* Significantly greater percentage at 0.05 level.

significant preference at six out of nine centres. The difference between the two systems (and the Winnipeg system's level of use is significantly greater than that of the Lakehead system) may be ascribed to the greater accessibility of the Lakehead cities to the members of its system, and Port Arthur and Fort William demonstrate significantly greater non-use of catalogues. This pattern of results is repeated for the minor settlements (Table 5.16).

TABLE 5.16

NORTHWESTERN ONTARIO: RECENT USE OF CATALOGUES IN MINOR SETTLEMENTS

	% using recently	% not using recently
Lakehead system	52.7	57.3
Winnipeg system	69.1*	30.9

* Significantly greater percentage at 0.05 level.

Negligible percentages of respondents report that they never use catalogues; and the items last purchased stress apparel goods, particularly adults' and children's fashion clothing, confirming the findings listed earlier for individual items.

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CHAPTER 6

VARIATIONS IN CONSUMER BEHAVIOUR

In the description and analysis of consumer behaviour presented in Chapters Four and Five the population of Northwestern Ontario is treated as a homogenous group and it is inferred that the structure of consumer behaviour and spatial preferences for selected items are characteristic of Northwestern Ontario throughout the year. It is pointed out in Chapter One, however, that the census figures indicate considerable ethnic diversity in Northwestern Ontario's population and that because of the differing nature of the economic bases of settlement the employment characteristics of the population vary. Additionally, the sample survey confirms that there are wide ranges in income levels. Also, in Chapter One the strong seasonal variations in climate are adumbrated. In this chapter, the possibilities of variation in ethnicity, income, employment, occupation, age and season affecting selected aspects of consumer behaviour are examined.

The aspects of consumer travel behaviour focused on are the related elements of choice of centre and distance travelled. Variations in choice of centre may be tested for significance utilising the chi-square test (explained in Chapter 4). The test utilised in analysis of distance variation has not yet been mentioned and it is explained below.

Where a sample population of distances is sub-divided into three or more strata or sub-populations according to some criterion, sample mean distances may be calculated for each stratum. To determine whether the differences amongst the sample means reflect real differences or whether they are due to chance, the Kruskal-Wallis H-test may be used (Ferguson, 1959, pp. 270-272). This test may loosely be regarded as the non-parametric equivalent of the parametric test for analysis of variance amongst sample means and it is used here because the distance data are not normally distributed. Whereas the rank-sum test employed in Chapters Four and Five tests for significant difference between two sample populations, the Kruskal-Wallis H-test tests for significant difference amongst three or more sample populations.

The relevant hypotheses are:

H_0: that the sample populations are from the same population and therefore differences amongst sample means are insignificant;

H_1: that the sample populations are not from the same population and therefore differences amongst sample means are significant.

The test is applied by combining the sample values, while retaining sample identity, and ranking the values: the lowest value is ranked 1, the second lowest 2, and so on. The sum of the ranks for each stratum may then be obtained and entered in the following formula:

$$H = \frac{12}{N\,(N+1)} \sum\left(\frac{R}{n}\right) - 3\,(N+1)$$

where n = number of observations in one stratum

N = number of observations in all strata

R = sum of ranks for one stratum.

Thus where the sample population has been divided into three strata there will be three values of $\frac{R}{n}$.

When ties occur, as they do in the distance data used in this study, the tied observations are assigned the average of the ranks they would otherwise occupy and the following correction factor is introduced:

$$1 - \frac{\Sigma T}{N^3 - N}$$

Thus the corrected formula is:

$$H = \frac{\frac{12}{N(N+1)} \sum \left\{\frac{R}{n}\right\} - 3(N+1)}{1 - \frac{\Sigma T}{N^3 - N}}$$

As an example, this formula has been applied to the sample distances travelled for children's clothes by the Lakehead dispersed population and the whole sample has been arranged into three strata according to income bands. The results are as follows:

No. in stratum	Income band($)	Mean distance travelled (miles)
12	0-2,999	15.5
37	3,000-5,999	10.8
40	6,000-9,999	7.2

The H-statistic has a value of 9.30 and with a critical value of 4.60 at the 0.05 level (2df) H_0 is rejected and H_1 is accepted.

The test was applied to the distance data for the

nucleated populations and problems were encountered at the aggregate level and at the level of individual settlements. It is shown in Chapter Four that there are three mean distances for each item: the extra-nucleation mean, the travel mean and the true mean. Further, it may be recalled that the rank-sum test could not be applied to the distance-sets from which the last two means are derived because of the large number of ties introduced by heavy use of home-settlements and the consequently large number of zero distances entered in the distance-sets. To analyse the different distances travelled by residents of differing income levels or occupational status, the distance-set from which the sample true mean is derived should be stratified. It can be stratified but the large number of ties overly distorts the Kruskal-Wallis test. Thus, only the distance-set from which the extra-nucleation mean is derived may be stratified and at both aggregate level and settlement level this introduces a fallacy: the different distances of those travelling outside of their home-settlements would be being compared, not the different distances travelled by the Northwestern Ontario population or by the residents of particular settlements. Moreover, the number travelling to centres outwith their home-settlements is generally so low that strata of reasonable size cannot be obtained. (A minimum number of five in each stratum is usually required.) Hence, analyses of differential distance are confined to the two dispersed populations, in the Rainy River area and at the Lakehead.

Equally, because eleven ethnic groups are considered, the numbers in the samples are generally too low to allow strata of reasonable size to be derived and significant inference on

space preferences made. In fact, the impression gained from the results presented in Chapter Five is that Northwestern Ontario residents have a restricted choice of centre: either they can use their own service centre or travel to the Lakehead or Winnipeg for most items, although it is true that at the Lakehead there is the choice between Port Arthur and Fort William.

DISPERSED POPULATIONS

Ethnicity

There are two main ways in which ethnicity may affect consumer travel behaviour. A member of an ethnic group may choose to patronise a particular establishment or service centre because it provides items oriented specifically towards his ethnic group, because those providing the item are members of the same ethnic group, or because other members of the same ethnic group visit that establishment or centre. Thus an overwhelming preference for a particular location may involve an ethnic group in travel distances different from those of other ethnic groups or the population at large. Equally, members of a particular ethnic group may react differently to distance, particularly as it is modified by climate, and different attitudes to distance may result in different spatial patterns of consumer travel behaviour.

Two studies specifically directed towards cultural variation and consumer travel behaviour may be mentioned. Murdie (1965) has shown how the overall cultural characteristics of Old Order Mennonites in Southwestern Ontario, involving *inter alia*

unsophisticated consumer demands and reliance on horse and buggy transportation, have produced lower travel distances for them as opposed to "modern" Canadians; and how one set of central places is used in two different ways by the Old Order Mennonites on the one hand and by "modern" Canadians on the other. Similarly, Ray (1967) has shown how places visited and distances travelled in the bicultural area of Eastern Ontario vary in association with the demands of English-speaking and French-speaking Canadians.[1]

Both of these studies involved substantial numbers of clearly-defined ethnic groups. In the Rainy River area, however, seventy-two per cent of the 102 respondents reported their ethnic origin as either British or Canadian, while twenty-five per cent reported their ethnic origin as being other than the choices provided (question number 16, Appendix 5). Thus no clearly-defined ethnic group emerges for detailed examination and comparison.[2]

In the Lakehead area, seventy-one per cent of the 192 respondents reported birth in Canada and sixty-three per cent of them reported their ethnic origin as either Canadian or British. The only other ethnic group of any size is the Finnish (19% of respondents). Their travel distances are not significantly different from either Canadians or all other respondents. Also,

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[1] In view of the findgins of this study, it should be noted that Ray ascribes many of the differences in mean distance travelled in his study-area to differences in dwelling locations.

[2] The Indian population provides an exception but, despite the writer's attempts to include reserve Indian populations in the sample survey, this line of investigation met no success. The Federal Department of Indian Affairs granted the writer permission to enter the reserves but repeated letters to the secretaries of band councils, requesting co-operation, evoked no response.

they exhibit no significantly distinctive spatial preferences in terms of overall shopping; but they do comprise almost all the clients of Kaministikwia, Lappe, Mokomom and Nolalu, for groceries (Figure 4.36a).

Income

Differences in income may produce differences in consumer travel behaviour in that those with higher incomes may travel further than those with lower incomes, inasmuch as the former can afford to pay more for travel costs than the latter. This tendency may not exist for any specific good or service, however, because a low-income group may travel just as far as, or farther than, a high-income group to obtain it and compensate by travelling less for other items or by economising in other areas of domestic expenditure.

For the Rainy River area income bands four and five (Question 39, Appendix 5) have been combined into the one income band of $10,000 and more and mean distance data for different income bands are compared. Significantly different distances are associated with different income levels in respect of only five of the twenty-five items examined (Table 6.1).

There is no consistent pattern amongst the items save for the distances in the third highest band (6,000 - 9,999) being lower than in the two lower income bands. Moreover, for all items except dentist the distances travelled by the highest income group are lower than the distances travelled by the two lowest income groups -- a reversal of the expectation outlined above. The locations of the different income bands were plotted (the map is not

TABLE 6.1

RAINY RIVER: DISTANCE VARIATION BY INCOME

Income Level ($)	Mean Distances Travelled (miles)				
	Drugs	Groc.	T.V.	Fam.Doc.	Dent.
0 - 2,999	16.4*	10.6	20.7	17.8	24.9
3,000 - 5,999	19.4	16.4	21.2	16.8	32.1
6,000 - 9,999	11.1	12.0	8.2	11.2	23.0
10,000 +	15.5	6.5	10.6	15.6	34.1

* All differences for single items significant at 0.05 level.

presented here) and it appears that the higher income groups live closer to Rainy River, Emo and particularly Fort Frances, while the lower income groups live farther away. Thus it is the location of the respondents that is primarily responsible for such distance differences as are observed.

For the Lakehead area, the fourth and fifth income bands were also combined and significantly different distances are associated with different income levels for twenty-three items out of the twenty-five (jewellery and farm machinery are the exceptions). The data set out in Table 6.2 reveal a general pattern of higher travel distances being associated with lower income levels and vice-versa: the lowest income group travels the longest distances, the next lowest group slightly shorter distances, the next lowest group even shorter distances and the next group slightly longer distances than the third group. The locations of the various income levels have been plotted (~~the map is not presented here~~ Figure 6.1) and, generally, income levels decline with distance from the two cities. Accordingly,

the higher travel distances associated with lower income groups is primarily a function of the location of the respondents of different income levels.

For both areas, it may be suggested that the slight variations in travel costs associated with variations in travel distances are compensated for by variations in other sectors of domestic expenditure.

Employment

Differences in employment might affect consumer travel behaviour in several ways. Firstly, differences in employment can result in differences in income levels, which in certain cases are themselves associated with different travel distances. Secondly, different industries can involve different work-locations and if place of work corresponds with place of purchase, different travel distances and different choices of centres may result. Thirdly, differences in employment may influence choice of centre and distances travelled through differential time demands and through different needs.

The clearest difference in employment patterns of both areas is between those households engaged in agriculture and those not; thus a comparison is drawn between agricultural respondents (item number 1 in questions 18 and 39, Appendix 5) and respondents reporting other employment (items 2 to 11 in questions 18 and 39).[1]

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[1] Responses to questions 18 and 19 are stratified so that only the employment of the head of the household is considered.

TABLE 6.2

LAKEHEAD: DISTANCE VARIATION BY INCOME (in miles)

Item	$ 0-3,000	$ 3,000-5,999	$ 6,000-9,999	$ 10,000 +
Mwc	13.3*	12.0	7.2	16.5
Ws	13.3	12.3	8.0	15.1
Ms	14.0	12.5	8.2	22.0
Tgc	10.0	12.1	7.5	6.5
Cc	15.5	10.8	7.2	7.1
Mc	14.8	12.4	8.1	7.4
Wc	14.4	11.8	8.3	15.1
Drugs	15.0	11.6	6.7	7.3
Groc.	11.2	8.4	5.8	7.0
Meat	11.2	8.0	5.8	6.7
T.V.	13.8	12.0	8.5	8.6
Refrig.	19.4	11.9	8.3	8.7
Furn.	15.4	12.2	8.0	8.1
Wa	14.4	13.3	7.8	8.0
Car	16.0	13.4	9.0	15.4
Fam.Doc.	15.5	11.3	7.4	7.8
Med.Spec.	18.7	11.9	8.0	8.3
Dentist	14.1	12.1	8.3	8.4
Lawy.	17.1	14.0	8.7	8.2
Car Ins.	15.6	12.5	7.6	8.5
Opt.	15.8	10.5	8.8	6.9
Bank	16.5	11.9	7.4	8.0
Hos.	17.1	11.8	7.0	8.2

* All differences for single items significant at 0.05 level.

In the Rainy River area one-third of the respondents reported being engaged in agriculture on a full-time basis and for half the items they travel distances significantly different from non-agriculturalists (Table 6.3). For all of these items farmers travel farther than non-farmers, but the difference ranges from over fifty miles (car) to one mile (hospital). Noticeably, those items for which (in Chapter 4) it is found that there is considerable travel out of the area (car, for example, Figure 4.7) involve a greater distance differential than those for which travel is more evenly-spaced over the area (family doctor, for example, Figure 4.29; and drugs, Figure 4.20). When most of the travel is out of the area the distance differential is difficult to explain; but where most travel is to Fort Frances, the differential is most likely due to respondent locational differences. Most of the farmers in the sample are located in the west and north of the area and have to travel longer distances than non-farmers to reach Fort Frances. Where travel is to centres more accessible to the whole dispersed population, the differential between farmers and non-farmers decreases.

Only fourteen per cent of the Lakehead sample reported being full-time farmers and the farming group is compared with the non-farming group for distances travelled. Farmers travel farther than non-farmers for twenty-two goods and less than non-farmers for one good (Table 6.4). There is little difference in the range of distances travelled for items by the dispersed population as a whole (Chapter Four) and the distance differentials, ranging from 4.8 miles to 0.5 miles,reflect this. No particular explanation may

TABLE 6.3

RAINY RIVER: DISTANCE VARIATION BY EMPLOYMENT

Distances (in miles)

Item	Agriculture	Non-Agriculture	Difference*
Car	90.2	47.5	52.7
Wc	58.7	27.2	31.5
Dent.	40.3	20.4	19.9
Refrig.	35.0	18.6	16.4
Ws	28.9	14.1	14.8
Mc	35.9	24.7	11.2
Lawy.	33.6	23.4	10.2
Mwc	25.3	18.4	6.9
Fam.Doc.	19.0	13.3	5.7
Drugs	19.0	13.7	5.3
Bank	20.6	16.0	4.6
Hos.	18.5	17.4	1.1

* All significant at the 0.05 level

be offered for the association of some items with higher differentials and others with lower differentials. A plot (not presented here) of the respondents by employment shows the farmers to be located farther from Port Arthur and Fort William than the bulk of the non-farming respondents and it may be suggested that the location of the farming respondents is primarily the cause of the distance differential.

It may be recalled that low-income groups, located farther from service centres than high-income groups, tend to travel farther than high-income groups, in both the Rainy River and Lakehead areas. Most farmers report low incomes, although

TABLE 6.4

LAKEHEAD: DISTANCE VARIATION BY EMPLOYMENT (miles)

Item	Distances		
	Agriculture	Non-Agriculture	Difference*
Cc	14.4	9.6	4.8
Med.Spec.	15.2	11.4	3.8
Car Ins.	14.2	10.8	3.4
Opt.	14.0	10.8	3.2
Dentist	13.8	10.8	3.0
Refrig.	14.6	11.7	2.9
Lawy.	15.0	12.2	2.8
Hos.	13.4	11.0	2.4
T.V.	13.2	10.8	2.4
Wa	13.8	11.4	2.4
Jew.	12.2	9.8	2.4
Tgc	10.9	8.6	2.3
Bank	13.2	11.0	2.2
Drugs	12.7	10.5	2.2
Mc	12.8	11.1	1.7
Groc.	9.6	8.2	1.4
Wc	13.4	12.0	1.4
Car	14.4	13.1	1.3
Mwc	12.9	11.7	1.2
Fu	12.2	11.3	0.9
Meat	8.6	8.1	0.5
Ws	12.7	12.0	0.5
Ms	12.7	13.3	0.6

* All differences significant at the 0.05 level.

their domestic expenditures are generally lower than the non-farming population because of the contribution of the farm to the household economy. It may be suggested that longer travel distances for low-income groups and farmers are related; and vice versa. The trend to sub-urbanisation of rural municipalities adjacent to Port Arthur and Fort William, and to Rainy River and Fort Frances (noted in Chapter One),involves the location of a non-farming population, with incomes higher than farmers, closer to the main service centres. Thus, the high-income groups and non-farmers, most of whom work in the main service centres, tend to travel shorter distances for goods and services than do low-income groups and farmers.

Ocuupation

Respondents in both areas were allocated to two occupational classes: a professional and management class and a composite class of skilled, semi-skilled and unskilled workers. In general, the latter class is found to travel farther for most goods and services than the former class. As this is a repetition of the findings detailed above for income and employment, the results are not presented.

Age

The main influence that age might have on consumer travel behaviour might be in older people continuing to use their customary service centres while younger people use newly-developed

service centres and, allied to this, older people may not be prepared to travel as far as younger people. In any event, no significantly different travel distances are associated with differences in age levels for either the Rainy River area or the Lakehead area.

SEASONAL VARIATIONS

The strong seasonal climatic contrasts experienced by Northwestern Ontario are described in Chapter One; and the sample survey indicates that there is considerable variation over Northwestern Ontario, from place-to-place and at the same place, in the perception of when winter begins and terminates. Some respondents feel that winter begins as early as September, while others place the onset as late as December; but most respondents select November. While perceptions of winter's termination range over the period February to May, most respondents perceive winter to finish in March. In addition to this temporal variation, the criteria employed to judge the onset and termination of winter vary: from temperature levels, snow fall, snow cover, ice on rivers and lakes, to changes in life-styles and work patterns.

It seems clear that winter means different things to different people and it may be hypothesised that winter affects consumer travel behaviour in that a greater number of consumers will use closer service centres in winter. For the nucleated population this would involve, particularly, greater use of the service centre of residence. Whether or not there is this seasonal variation in spatial behaviour, it may also be hypothesised

that the strong seasonal contrasts are associated with changes in the mode of transport and in the frequency of shopping trips.

Variation in centre visited, between summer and winter, could produce distance differences. Although the sample mean summer travel distances are higher than the equivalent winter measures, for both dispersed populations and the aggregated nucleated populations, the differences are not statistically significant. This is not surprising, in view of the lack of significant variation in the use of service centres by the dispersed populations (Table 6.5) and in the heavy use of home settlements by the nucleated populations (Table 6.6).

TABLE 6.5

DISPERSED POPULATIONS: SEASONAL VARIATIONS IN SERVICE CENTRE CHOICE

Rainy River

	FF	E	RR	O
Summer	45*	18	17	22
Winter	47	16	18	21

Lakehead	PA	FW	O
Summer	88	96	8
Winter	87	96	9

* Actual numbers of respondents.

Only three centres experience significantly lower use of the home settlement and correspondingly more travel in summer, although the trend at most of the other centres is for less use of the home

TABLE 6.6

NUCLEATED POPULATIONS: SEASONAL VARIATION IN USE OF HOME SETTLEMENT

	Winter			Sumer	
Centre	HS%	Travel%		HS%	Travel%
Port Arthur	99.4	0.6		98.6	1.4
Fort William	95.0	5.0		88.2	11.8
Atikokan	94.3	5.7		94.4	5.6
Geraldton	95.3	5.7		88.4	11.6
Nipigon	93.5	6.5	*	74.2	25.8
Terrace Bay	82.8	17.2		74.2	25.8
Schreiber	87.5	12.5		75.0	25.0
Marathon	88.6	11.4	*	72.7	27.3
Manitouwadge	87.9	22.1		80.0	20.0
Longlac	100.0	0.0		93.8	6.2
Nakina	66.6	33.4		50.0	50.0
Red Rock	44.8	55.2	*	20.7	79.3
Beardmore	83.3	16.7		66.6	33.4
Dryden	90.4	9.6		89.4	10.6
Fort Frances	96.9	3.1		93.9	6.1
Kenora	93.7	6.3		88.3	11.7
Red Lake	88.9	11.1		62.9	37.1
Rainy River	100.0	0.0	*	95.8	4.2
Sioux Lookout	82.4	17.6		79.4	20.6
Emo	76.9	13.1		91.7	8.3
Keewatin	36.7	63.3		40.0	60.0
Balmertown	85.0	15.0		65.0	35.0

* Significant winter/summer difference at 0.05 level.

settlement in summer and more in winter. Of the three centres with significant variation, two are third order centres (Nipigon and Marathon) and one is a second order centre (Red Rock). At these three centres, as well as the others, the main reasons given for altering the main shopping venue between winter and summer are that travelling is too dangerous and that it is too cold to travel far. The highway along the north shore of Lake Superior is reputedly the most dangerous road to drive in Northwestern Ontario, a condition brought about by the steep grades and sharp bends of the road and the uncertain winter road-surface conditions occasioned by winds with a high moisture content blowing off the ice-surfaced Lake Superior. But it is not easy to ascribe the variations at these three centres to this when other centres located on that highway exhibit no variation.

That there is not a more widespread seasonal variation exhibited is perhaps due to the forms of the questions: respondents were requested to identify the centre in which they did most of their shopping in winter and most in summer. This is a very high level of generalisation and it appears that the responses identify the centres utilised for meat and groceries. More seasonal variation might have been isolated if specific items had formed the basis of the questions.

Although consumers may not vary in their choice of centre between summer and winter, it is possible for them to modify their travel behaviour by altering the frequency of their shopping trips. While there is no significant variation in the Rainy River area it is possible to state that a significantly greater percentage

of the Lakehead dispersed population does not cut down on the number of shopping trips in winter (Table 6.7).

TABLE 6.7

DISPERSED POPULATIONS: SEASONAL VARIATIONS IN FREQUENCY OF SHOPPING TRIPS

	Winter Reduction(%)	No Winter Reduction(%)
Rainy River	48	54
Lakehead	33.7	66.3*

* Significantly higher percentage at 0.05 level.

Only five centres exhibit a significant reduction of the number of shopping trips in winter: four of these are in the Lakehead system and three of these four are located on the north shore of Lake Superior; while one of them is in the Winnipeg system (Table 6.8). These centres apart, there is no significant variation at any other centre, save at Rainy River where there is significantly no reduction in number of shopping trips in winter. That there is not more winter reduction in travel is perhaps due to the relatively high use of the home centre in summer; and the question posed to respondents did not differentiate between shopping trips within their centre of residence and shopping trips to other centres and involving travel (questions 9i and 9ii, Appendix 5).

A distinction was drawn, however, between home settlement and use of other centres, when consumers were questioned as to their modes of transport in summer and in winter: they were asked to identify the form of transport used in shopping trips to centres other than that in which they reside (questions 9iii and 9iv, Appendix 5).

TABLE 6.8

NUCLEATED POPULATIONS: SEASONAL VARIATIONS IN FREQUENCY OF SHOPPING TRIPS

Centre	Winter Reduction(%)	No Winter Reduction(%)
Port Arthur	47.0	53.0
Fort William	40.0	60.0
Atikokan	41.7	58.3
Geraldton	54.8	45.2
Nipigon	71.9*	28.1
Terrace Bay	80.0*	20.0
Schreiber	30.8	69.2
Marathon	83.4*	16.6
Manitouwadge	73.5*	26.5
Longlac	66.6	34.4
Nakina	56.3	43.7
Red Rock	58.6	41.4
Beardmore	33.4	66.6
Dryden	59.6*	40.4
Fort Frances	54.5	45.5
Kenora	56.7	43.3
Red Lake	53.8	46.2
Rainy River	30.4	69.6*
Sioux Lookout	51.5	49.5
Emo	50.0	50.0
Keewatin	63.3	36.7
Balmertown	60.0	40.0

* Significantly higher percentage at 0.05 level.

Most respondents own their own form of transport, either a car or truck, and most others may obtain the use of one. In summer, it may be argued, most respondents will use their own form of transport; but in winter, there may be a signficant change to taxis, buses or trains, as respondents may not wish to risk their own vehicles on the road in dangerous driving conditions or may wish to avoid the road altogether. At only one place (Kenora), however, is the use of car and truck significantly higher in summer than it is in winter. Most of those not using car and truck in winter report use of the train and this is mainly to Winnipeg.

Discussion

Because the structure of consumer behaviour in Northwestern Ontario involves a high level of use of home-settlements for most items and concomitantly a large proportion of zero distances, even a test as robust as the Kruskal-Wallis H-test may not be used to test for variations in the distances travelled by nucleated populations. Distance variations do exist in the areas of dispersed population and it is held that these are more a function of dwelling location rather than preference for travel or ability to pay for it.

Similarly, because of the low proportions of extra-nucleation travel within small sample-sizes, no definite preferences for particular service centres, influenced by factors such as ethnicity or socio-economic status, can be detected.

It may be that the research design is too general and the samples too small for distance variations and choice of centre variations clearly to emerge. A more specific research design might reveal greater variation. On the basis of the evidence presented here, however, the overwhelming impression is that of similarity amongst the Northwestern Ontario population, in terms of consumer behaviour.

Temporal variation in distances travelled, use of centres, mode of transport and frequency of shopping trips, in association with marked climatic variation, is shown to be negligible. It may be argued that winter's negligible influence on consumer behaviour reflects Northwestern Ontario residents' frontier image of themselves and that similar winter conditions would affect consumer behaviour more markedly in non-frontier areas; but in non-frontier areas service centres are more evenly-spaced and more closely-spaced, thereby reducing the distances over which winter conditions may exert modifying influences. The negligible temporal variations demonstrated here, however, serve to strengthen the validity of the respondents' generalisations of their consumer behaviour reported in Chapter Five.

Works Cited

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CHAPTER 7

CONCLUSIONS

Northwestern Ontario is designated as a frontier area on the bases of low population density, the recency of the founding of most settlements, irregular settlement spacing and its residents notions of their environment and themselves.

Central place theory is taken to express conditions of service provision and consumer behaviour in non-frontier areas and examination of these elements in Northwestern Ontario reveals certain similarities with non-frontier areas and differences which may be related to frontier conditions. Comparison between Northwestern Ontario and non-frontier areas, however, is complicated by variation within Northwestern Ontario itself, the intrinsic qualities of the Northwestern Ontario data and by a dearth of studies reporting in terms and measures comparable to those generated in this study.

Recalling the seven criteria diagnostic of a service centre hierarchy outlined by Marshall (1969, p. 23), this study reveals the existence of two systems of service centre in Northwestern Ontario: a complete system (2)[1] focused on the Lakehead (1) and part of a system focused on Winnipeg (1). In Chapter Three evidence is presented for regarding these systems as being

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[1] Numbers alone in parentheses accord with criteria numbers at the beginning of Chapter 3.

discretely stratified into hierarchical groups (3) and it is demonstrated that service centres at different levels may be differentiated by incremental baskets of goods (5). Analyses of service eqipment and the structural and spatial characteristics of consumer behaviour suggest the existence of at least three orders of service centre (6). For five of the seven categories, therefore, service provision in Northwestern Ontario tends to resemble that in non-frontier areas.

It tends to differ from it in respect of two categories: interstitial placement of orders (4) and numerical pyramid in order membership (7). Marshall (1969, p. 26) exemplifies the former characteristic with the question, "Why is this centre of town stature in this village location?"; which is a specific formulation of the more general question, "Why are service centres of a certain status located where they are rather than where one expects them to be?". This, of course, assumes that observed locations of service centres do not correspond with locations expected on a basis of maximum accessibility.

In Northwestern Ontario there are instances of interstitial placement of orders within a linear framework. Along Highway 11 in Rainy River (TD) the sequence is: Fort Frances (4th order); Devlin and La Vallée (1st order); Emo (2nd order); Barwick, Pinewood and Stratton (1st order); and Rainy River (3rd order). This is in an area of dispersed population but interstitial placement of orders also occurs, without a large dispersed population, along Highway 11 to the east of and including Nipigon: Nipigon (3rd order); Macdiarmid (1st order); Beardmore (2nd order); Jellicoe (1st order); Geraldton (3rd order);

and Longlac (2nd order). Equally there are instances of service centres of the same order located adjacently (Port Arthur and Fort William, 5th order) or in close proximity (Schreiber and Terrace Bay, 3rd order).

More generally, whereas most consumer travel in the Lakehead system focuses on Port Arthur and Fort William, these two cities are not located at the point of maximum accessibility. Given the present disposition of settlements to the east of the Lakehead, the Nipigon location seems to be more accessible.

Overall, the placement of orders in Northwestern Ontario cannot be described as interstitial nor do the main focii of consumer travel occupy locations of maximum accessibility. These features emphasise the point, developed in the first chapter, that most settlements in Northwestern Ontario were not founded to supply a wider population; although some have subsequently developed a wider service role, particularly when their economic bases support relatively large resident populations exerting a demand for goods and services

Nor are there numerical pyramids in order membership in Northwestern Ontario. Because the Winnipeg system, as described here, is incomplete, little comment may be offered on the numerical sequence from fourth to first order of 3:3:5:23; but the Lakehead system's sequence, from fifth to first order (2:0:7:4:20) may be explained by historical events and the characteristics of resource development in a frontier area.

The tributary areas of service centres are regarded here as amalgams of service areas. Tributary areas may be

delimited on the basis of service area amalgamation or on the basis of a single service area, usually that of maximum reach. Jones (1966, pp. 97-100) points out that the former procedure may be difficult when there is considerable variation in the shape and extent of the service areas. The writer feels that the Winnipeg and Lakehead tributary areas may be delimited on the basis of the service with maximum reach, medical specialist, and thus they are implicitly delimited in Figure 5.9. Further, the Port Arthur and Fort William tributary areas may be considered as almost spatially co-extensive, though differing in intensity in favour of the former, as far as the nucleated population is concerned. Jones (1966, p. 85) describes the general condition of the tributary areas of smaller service centres nesting within the tributary areas of larger service centres; and it may be inferred that Jones is referring principally to non-frontier areas. Because no *tributary areas* are delimited for centres other than Winnipeg, Port Arthur and Fort William, no comparison may be made between Northwestern Ontario and non-frontier areas on this point. But comparison of Figures 5.9-5.18 shows how *service areas* of items involving consumers in low mean travel distances tend to nest within those of items associated with high mean travel distances. Similarly, Figures 4.5-4.28 reveal Emo and Rainy River service areas nesting within Fort Frances service areas. Thus the notion of nesting of service areas, identified as characteristic of non-frontier areas, is also characteristic of Northwestern Ontario.

Christaller (1955, pp. 49-58) distinguishes between the ideal range of an item -- the maximum distance consumers are

willing to travel -- and the real range -- the distance consumers actually travel when there are two or more competing centres offering the same item. Smailes (1953, p. 140) has developed this point in a more general way, for non-frontier areas with closely-spaced service centres, pointing out that a service centre's tributary area

> is not usually worked out fully in all directions to the extreme limit of its several services. Instead it is cut short by entry into the field of attraction of other centres ...so that these are marginal areas of competition between towns.

In the frontier area of Northwestern Ontario, where some service centres are close together and others far apart, conditions in this respect vary. Overall, there does not seem to be much competition between the Lakehead and Winnipeg systems, except perhaps at Atikokan (Figures 5.9-5.18): nucleations tend to be firmly in one system or the other. In the Rainy River area, there appears to be competition amongst some centres, as evidenced by overlapping of desire lines; and similarly there is the marked zone of overlap of Port Arthur and Fort William service areas for the dispersed population (Chapter 4). Additionally, over the Lakehead system there is competition between Port Arthur and Fort William (Chapter 5). Thus, the frontier does experience competition amongst towns, especially where they are closely-set. When very distinct service areas are present, with little or no crossing of desire lines, it is difficult to know if ideal and real ranges of items are coinciding or if competitive opportunities are meeting extremely sensitive responses from consumers. On

the face of it, where the frontier is characterised by widely-separated service centres ideal and real ranges might coincide, but it is difficult to prove.

It is also difficult to demonstrate that Northwestern Ontario consumers travel less or farther than consumers in non-frontier areas, because similar studies employ mean distances or ranges based on means and standard deviations and the distance data generated in this study are skewed in distribution. Also hampering comparison between this and other studies is variation in the items to which distance data apply. Both Berry (1967) and Murdie (1965), for example, present distance data for highly-generalised items ("food" and "clothing"), which may not be validly compared with the distance data for more specific items gained in this study. Finally, most other studies of consumer behaviour have dealt with dispersed populations and there is, therefore, little or no distance data available for comparison with the Northwestern Ontario nucleated population. Limited comparisons may be attempted between dispersed consumers' travel for selected items in the study area, Iowa and Eastern Yorkshire (Tables 7.1 and 7.2).

Even with allowance for the unreliability of the Northwestern Ontario sample means, the general impression is of greater variation between parts of the frontier area than between the frontier area and the representative non-frontier area fo Iowa (Table 7.1). Both parts of the frontier area, however, seem to involve slightly higher distances than those travelled in Eastern Yorkshire (Table 7.2).

TABLE 7.1

DISPERSED POPULATIONS: COMPARISON OF IOWA AND NORTHWESTERN ONTARIO TRAVEL DISTANCES

Item	Iowa* $\bar{x}$	Rainy River $\bar{x}$	Lakehead $\bar{x}$
Car	18.8 +/- 2.1	62.3 +/- 15.1	14.1 +/- 2.9
Furniture	17.6 +/- 2.5	34.4 +/- 10.4	11.3 +/- 1.6
Women's Coat	14.1 +/- 3.1	39.5 +/- 14.1	12.1 +/- 2.6
Dentist	10.9 +/- 0.8	27.3 +/- 6.5	11.1 +/- 1.6
Family Doctor	10.4 +/- 1.2	15.4 +/- 2.4	11.0 +/- 1.6
Men's Coat	8.2 +/- 0.5	31.8 +/- 11.0	11.3 +/- 1.6
Groceries	5.2 +/- 0.3	12.4 +/- 2.4	8.3 +/- 1.2

*Standard errors of the Iowa means calculated by the writer on the basis of data contained in Table 4.6 (All ranges are significant at 0.05 level of confidence.)

TABLE 7.2

DISPERSED POPULATIONS: COMPARISON OF EASTERN YORKSHIRE AND NORTHWESTERN ONTARIO TRAVEL DISTANCES

Item	E. Yorks $\bar{x}$	Rainy River $\bar{x}$	Lakehead $\bar{x}$
Women's shoes	9.6 +/- 0.9	18.9 +/- 6.3	12.0 +/- 2.5
Men's shoes	9.1 +/- 0.8	15.7 +/- 3.1	13.1 +/- 3.1
Television	8.3 +/- 0.8	15.9 +/- 5.9	14.5 +/- 5.7
Bank	8.0 +/- 1.0	16.6 +/- 2.4	11.1 +/- 1.6

*Adapted from Tarrant, 1967, Table 14, p. 56. (All ranges significant at the 0.05 level of confidence.)

Comparison of the level of catalogue purchases between this frontier area and non-frontier areas is also difficult, mainly because of a dearth of data comparable to that gathered here. Berry (1967), for example, amalgamates purchases made by catalogue and in low order service centres. Comparison with data supplied by Luck (1948) is unlikely to be fruitful because of the temporal gap and the lack of error limits for Luck's data. In any event, in view of the variation between parts of this frontier area, such as that demonstrated in Chapter Four, comparison would be difficult even were comparable data available.

Whereas two studies in non-frontier areas have been able to demonstrate variation in consumer travel behaviour ascribable to cultural differences, little variation ascribable to such differences emerges in this frontier area. Nor does seasonal variation in different aspects of consumer behaviour reach significant dimensions. This may be due to the restricted service provision opportunities of a frontier area and to hardy frontiersman attitudes to travel in winter or it may be due to inadequacies of the research design.

On balance, then, systems of service provision and patterns of consumer behaviour in Northwestern Ontario possess characteristics redolent of non-frontier areas, as described in central place theory and in empirical studies, and include features which may be linked to the frontier nature of Northwestern Ontario.

Works Cited

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Luck, D.J. (1948), *Consumer Buying Habits in the Crab Orchard Area of Illinois* (Business Studies -- No. 8, University of Illinois, Urbana).

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Smailes, A.E. (1953), *The Geography of Towns* (London).

Tarrant, J.R. (1967), *Retail Distribution in Eastern Yorkshire in Relation to Central Place Theory: A Methodological Study*, Occasional Papers in Geography No. 8 (Hull).

APPENDIX 1

SUPPLEMENTARY POPULATION DATA, 1966*

Armstrong	427
Cameron Falls	235
Caramat	462
Cochenour	775 **
Ear Falls	611
Emo	824 **
Heron Bay	192
Hudson	831
Hurkett	68
Ignace	795 **
Jellicoe	188
Jumbo Gardens	623 **
Kakabeka Falls	346 **
Madsen	566
Macdiarmid	11
McKenzie Island	327
Nakina	671 **
Nestor Falls	120
Raith	116
Sapawe	112
Savant Lake	186
Sioux Narrows	504 **
Stevens	124
Upsala	275 **
Vermilion Bay	552 **

* DBS, *Census of Canada*, 1966

** Assessed Population, 1967 (census figures not available).

APPENDIX 2

PILOT QUESTIONNAIRE POSTALLY ADMINISTERED IN MANITOUWADGE

Covering Letter

L A K E H E A D U N I V E R S I T Y

Department of Geography

Survey of Shopping Habits

May 27, 1968

Dear Sir/Madam:

The Department of Geography is carrying out a survey of the places people visit to shop and to obtain services. At the conclusion of the survey it is hoped that a total picture of the facilities people use and need in Northwestern Ontario will be gained. It is only from an extensive study such as this that demands for improved shopping facilities and services can be judged and the facilities themselves improved. Therefore, to make this survey a success, I ask you to complete the enclosed questionnaire and return it to me in the enclosed, stamped envelope.

All replies will be treated in confidence and there is no need to sign the questionnaire nor to place your address on it.

Thank you for your co-operation,

IVOR DAVIES

(Lecturer in Geography)

ID/emw

Enc. 2

SURVEY OF SHOPPING HABITS IN NORTHWESTERN ONTARIO

Computer No. - 2-13

1. In what towns/villages do you buy the following? Write the name of the town/village in the space provided.

	All the time	Most of the time	Sometimes
a) Men's work clothes			
b) Women's shoes			
c) Men's shoes			
d) Teenage girls' clothes			
e) Children's clothes			
f) Men's suit			
g) Women's coat			
h) Drugs			
i) Groceries			
j) Meat			

2. Name the city (or town or village) in which you last bought the following goods. Write the name of the town/village in the space provided.

	Name of town	Reason
a) Television set		
b) Refrigerator		
c) Furniture		
d) Watch		
e) Jewellery		
f) Car		

State your reason/reasons for going to that place for each item in the space provided.

3. In what town do you have

a) your car serviced _____
b) your watch serviced _____
c) your television serviced _____

4. List goods which you buy by catalogue and indicate how often by placing an X in the appropriate box.

Name of object	All the time	Most of the time	Sometimes
a) _____	☐	☐	☐
b) _____	☐	☐	☐
c) _____	☐	☐	☐
d) _____	☐	☐	☐
e) _____	☐	☐	☐
f) _____	☐	☐	☐

5. Why do you use catalogues? List your reasons.

i) _____

ii) _____

iii) _____

iv) _____

6. In column A name the town where you most often obtain the services of the following. In column B name any other town where you sometimes obtain these services.

	A	B
i) Doctor	_____	_____
ii) Dentist	_____	_____
iii) Lawyer	_____	_____
iv) Optometrist	_____	_____
v) Car Insurance	_____	_____
vi) Bank	_____	_____
vii) Hospital	_____	_____

7. Place a cross (X) in the box provided if you have visited any of these towns in the last year.

		Name any goods you purchased
i) Winnipeg	☐	_____
ii) Toronto	☐	_____
iii) Duluth/Superior	☐	_____
iv) Minneapolis/St. Paul	☐	_____
v) Sault Ste. Marie	☐	_____

8.

a) Name any of the above towns which you visit regularly to shop.

b) How many times have you visited each to shop in the last 12 months?

	Once/Month	Once/Year	Twice/Year
_____	☐	☐	☐
_____	☐	☐	☐
_____	☐	☐	☐
_____	☐	☐	☐
_____	☐	☐	☐

To help us interpret the results please provide us with some personal details.

9.

a) Do you have a summer cottage? Mark X. Yes ☐ No ☐

b) If yes - where is it? _____

c) How many miles away from your home is it? _____ miles.

d) Circle the months you spend there.

Jan. Feb. Mar. Ap. May June July Aug. Sept. Oct. Nov. Dec.

e) When you are there do you use towns not listed in Question 1 for shopping? Mark X.

Yes ☐ No ☐

f) If yes - name the goods and towns where bought.

Kind of thing bought	Name of town bought in
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

10.

i. Are you presently single or married? Place X in box.

Single ☐ Married ☐

ii. What kind of work do you do? _____

What kind of work does your husband/wife do? _____

In what town do you work? _____

In what town does your wife/husband work? _____

11. What ethnic group do you think you belong to? _____

12. In what year were you born? _____

13. How many years have you lived in this town? _____ years.

14. Are you eligible for Canadian Citizenship? Yes ☐ No ☐

Have you taken out Canadian Citizenship? Yes ☐ No ☐

15.

a) If you are single or if only one of the husband and wife is presently working place an X in the box opposite the scale into which your income for the last 12 months falls.

Less than $3,000 ☐

$3,000 - $4,500 ☐

$4,500 - $6,000 ☐

$6,000 - $8,000 ☐

More than $8,000 ☐

b) If you are <u>married</u> and both you and your husband (wife) presently work place an X in the box opposite the scale into which your total combined incomes for the last 12 months fall.

Less than $3,000	☐
$3,000 - $4,500	☐
$4,500 - $6,000	☐
$6,000 - $8,000	☐
More than $8,000	☐

APPENDIX 3

THE QUESTIONNAIRE ADMINISTERED IN THE PILOT SAMPLE SURVEY OF RED ROCK

Letter of Authority

L A K E H E A D U N I V E R S I T Y

Department of Geography

Survey of Shopping Habits

May 25, 1968

To whom it may concern:

This is to identify Mr./Mrs./Miss _____,
who is assisting the Department of Geography, Lakehead University, in carrying out a survey of shopping habits in Northwestern Ontario.

I would be most grateful if you would agree to supply the information requested. All your replies will be treated in the strictest confidence.

Yours sincerely,

IVOR DAVIES

ID/emw

(Lecturer in Geography)

DEPARTMENT OF GEOGRAPHY

LAKEHEAD UNIVERSITY

CONSUMER BEHAVIOUR SURVEY

INTERVIEWER _____
(Name)

RESPONDENT ADDRESS

1. NUCLEATED SETTLEMENT a) _____ _____
House/Apt. No. Street

Name of Settlement b) _____

OR

2. SINGLE DWELLING a) _____ _____
Lot No. Concession No.

Township b) _____

3. IDENTIFICATION NO. _____

4. RESPONDENT NO. _____

RECORD OF VISITS

Visit	Time	Day	Date	Month	Year	Not In Mark X	No Response Mark X	Response Mark X
1								
2								
3								

Hello. My name is _____. I am working for the Department of Geography, Lakehead University and I am taking a survey of shopping habits of people in Northwestern Ontario.

(Interviewer: ask both sections of a question, then proceed to the next.)

1.	In what town did you last buy?	In what town do you usually buy?
a) Men's work clothes	_____	_____
b) Women's shoes	_____	_____
c) Men's shoes	_____	_____
d) Teenage girls' clothes	_____	_____
e) Children's clothes	_____	_____
f) Men's suit	_____	_____
g) Women's coat	_____	_____
h) Drugs	_____	_____
i) Groceries	_____	_____
j) Meat	_____	_____

2. When you decide what town to shop in for an item what things do you consider?

i) _____

ii) _____

iii) _____

iv) _____

(Interviewer: ask both sections of a question, then proceed to the next.)

3.	In what town did you last buy?	Why did you buy it there?
a) Television set	_____	_____
b) Refrigerator	_____	_____
c) Furniture	_____	_____
d) Watch	_____	_____
e) Jewellery	_____	_____
f) Car	_____	_____

4. In what town do you have your

a) car serviced? _____

b) watch serviced? _____

c) television serviced? _____

5.

a) What have you bought by catalogue in the last six months?

		Yes	No
_____ _____	Do you usually buy this by catalogue?	☐	☐
_____ _____	Do you usually buy this by catalogue?	☐	☐
_____ _____	Do you usually buy this by catalogue?	☐	☐
_____ _____	Do you usually buy this by catalogue?	☐	☐
_____ _____	Do you usually buy this by catalogue?	☐	☐
_____ _____	Do you usually buy this by catalogue?	☐	☐

b) Why did you buy those items by catalogue?

i) _____

ii) _____

iii) _____

iv) _____

v) _____

(Ask "last" for a)-g)*; then ask "most often" for* a)-g)*)*

6.

	In what town did you last	In what town do you most often
a) see a doctor?	_____	_____
b) see a dentist?	_____	_____
c) see a lawyer?	_____	_____
d) see an optometrist?	_____	_____
e) see about car insurance?	_____	_____
f) visit a bank?	_____	_____
g) visit a hospital?	_____	_____

7.

a) What towns outside of Northwestern Ontario have you visited to do shopping or to obtain services in the last twelve months?

Names of Towns	What did you buy there?
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

b) Which town did you visit most often? _____

c) Why do you go there? _____

_____

_____

Now, to help us study these results I would like you to answer some questions about yourself.

8.

		Single	Married
a)	Are you presently single or married?	☐	☐
		Yes	No
b)	i. Are you working at present?	☐	☐
	ii. What kind of work do you do? _____		
		Yes	No
c)	*If applicable* - i. Is your husband/wife working at present?	☐	☐
	ii. What kind of work does he/she do? _____		

If respondent is male or single

9.

a) What category does your income fall into? *Show card A.*

- i) Less than $3,000 ☐
- ii) $3,000 - $4,500 ☐
- iii) $4,500 - $6,000 ☐
- iv) $6,000 - $9,000 ☐
- v) More than $9,000 ☐

If respondent is married and both work

b) What category does the combined income of you and your wife/husband fall into? *Show card A.*

- i) Less than $3,000 ☐
- ii) $3,000 - $4,500 ☐
- iii) $4,500 - $6,000 ☐
- iv) $6,000 - $9,000 ☐
- v) More than $9,000 ☐

10. Yes No

i. Do you have a summer cottage? ☐ ☐

ii. *If yes:* Where is it? _____

iii. How many miles from here is it? _____ miles.

iv. Do you live in it for the summer? Yes ☐ No ☐

a) *If yes:* What months do you live there? *(Circle)*

Jan. Feb. Mar. Ap. May June July Aug. Sept. Oct. Nov. Dec.

b) When you are there do you shop at towns/villages different from those you use when living at home? Yes ☐ No ☐

v. Do you stay there at weekends? Yes ☐ No ☐

11. What ethnic group do you think you belong to?

_____

12. Are you a Canadian citizen? Yes ☐ No ☐

If no: Are you eligible for citizenship? Yes ☐ No ☐

13.

i. In what month does winter begin? _____

ii. Why do you say that? _____

iii. In what month does winter end? _____

iv. Why do you say that? _____

14.

i. Are you prepared to shop in the same towns in winter as those you shop in in summer? Yes ☐ No ☐

ii. *If no:* Why not? _____

_____

15. In what town do you work? _____

By Car Bus Foot Train

How do you get to work? ☐ ☐ ☐ ☐

In what town does your wife/husband work? _____

By Car Bus Foot Train

How does she/he get there? ☐ ☐ ☐ ☐

When Interview is over, to be completed by Interviewer.

1. Respondent was: - Male ☐ Female ☐

2. Linguistic communication between respondent and yourself was: -

Good ☐ Fair ☐ Poor ☐

3. What questions did the respondent have difficulty answering?

Nos.

4. For what reasons?

5. What questions did the respondent seem unwilling to answer?

Nos.

APPENDIX 4

DIMENSIONS OF CENTRES, SAMPLE SIZES AND RESPONSE RATES

1% SAMPLING FRACTION

	Pop	FS	HC	HA	S	SO	RR*
Fort William	48,203	3.5	13,772	--	137	122	95
Port Arthur	46,718	3.6	12,977	--	129	154	100

4% SAMPLING FRACTION

	Pop	FS	HC	HA	S	SO	RR
Fort Frances	9,112	3.5	2,603	--	104	67	84
Kenora	10,833	3.4	3,186	--	127	111	87

6% SAMPLING FRACTION

	Pop	FS	HC	HA	S	SO	RR
Atikokan	6,586	3.8	1,733	--	103	36	35
Balmertown	1,754	3.9	450	--	27	22	82
Dryden	6,718	3.7	1,815	--	108	105	97
Geraldton	3,258	3.8	857	--	51	43	84
Keewatin	2,009	3.6	558	--	33	30	91
Manitouwadge	3,269	3.7	883	--	52	43	83
Marathon	2,605	3.7	704	--	42	36	86
Nipigon	2,734	3.7	739	--	44	31	71
Red Lake	2,510	3.9	643	--	38	27	71
Red Rock	1,913	3.7	517	--	31	29	94
Schreiber	2,204	3.7	595	--	35	16	46
Sioux Lookout	2,651	3.9	679	--	40	34	34
Terrace Bay	1,824	3.7	493	--	30	31	100

---

*Pop: population, 1967 assessed if available, or 1966 census; FS: Family size, 1966 (or 1961) census, for centre if available, for district if not; HC: No. of households calculated; HA: No. of households enumerated; S: Sample Size; SO: Sample Size obtained; RR: Response rate as a percentage.

8% SAMPLING FRACTION

	Pop	FS	HC	HA	S	SO	RR
Beardmore	950	3.7	243	--	19	12	63
Cochenour	775	3.9	199	--	16	14	88
Ear Falls	--	--	--	223	18	17	94
Emo	824	3.8	216	--	17	13	76
Hudson	831	3.9	213	--	17	--	--*
Ignace	711	3.9	182	--	14	9	64
Jaffray-Melick	--	--	--	449	36	35	97
Jumbo Gardens	623	3.7	168	--	13	16**	100
Longlac	1,339	3.7	362	--	28	17	61
Madsen	1,102	3.9	282	175	14	11	79
Nakina	667	3.7	180	--	14	12	86
Rainy River	1,109	3.4	326	--	26	24	92

10% SAMPLING FRACTION

	Pop	FS	HC	HA	S	SO	RR
Armstrong	472	3.7	127	119	11	3	27
Borups Corners	--	--	--	7	1	1	100
Barclay	--	--	--	11	1	2**	100
Cameron Falls	235	3.7	63	61	6	4	66
Caramat	--	--	--	--	--	--	--*
Devlin	--	--	--	32	3	3	100
Dinorwic	296	3.9	76	64	6	3	50
Dorion	--	--	--	5	1	5	100
Eagle River	--	--	--	26	3	3	100
Gunne	--	--	--	6	1	1	100
Heron Bay	192	3.7	52	55	6	6	100
Heron Bay South	87	3.7	23	27	3	4	100
Jellicoe	188	3.7	51	47	5	3	60
Kakabeka Falls	346	3.7	93	96	10	10	100
La Vallee	--	--	--	23	2	2	100
Macdiarmid	--	--	--	35	3	5**	100
McKenzie Island	327	3.9	84	62	6	4	66
Minnitaki	67	3.9	17	12	1	1	100
Murillo	115	3.7	31	40	4	10**	100
Nestor Falls	120	3.9	31	30	3	3	100

---

*The questionnaires for Wabigoon and Hudson were inadvertently destroyed. The road to Caramat and Stevens was impassable at the time of the sample survey.

**In some cases interviewers found it expedient to interview more households than required.

10% SAMPLING FRACTION

	Pop	FS	HC	HA	S	SO	RR
Oxdrift	--	--	--	17	2	3	100
Pinewood	33	3.8	8	18	2	3	100
Rabbit Lake	--	--	--	41	4	4	100
Raith	116	3.7	31	22	2	2	100
Redditt	--	--	--	37	4	4	100
Rosslyn	96	3.7	26	86	9	9	100
Rossport	128	3.7	34	31	3	3	100
Sioux Narrows	295	3.9	75	69	7	5	71
Sleeman	--	--	--	15	2	2	100
Stevens	124	3.7	33	--	--	--	--*
Stratton	110	3.7	29	36	4	4	100
Upsala	275	3.7	74	60	6	2	33
Vermilion Bay	552	3.9	136	113	11	8	73
Vickers Heights	--	--	--	112	11	11	100
Wabigoon	439	3.9	112	--	--	--	--*

APPENDIX 5

THE QUESTIONNAIRE ADMINISTERED TO THE SAMPLE POPULATION

Letter of Authority

L A K E H E A D U N I V E R S I T Y

Department of Geography

Survey of Shopping Habits

July 23, 1968

To whom it may concern:

This is to identify Mr./Mrs./Miss _____,
who is assisting the Department of Geography, Lakehead University, in carrying out a survey of shopping habits in Northwestern Ontario.

I would be most grateful if you would agree to supply the information requested. All your replies will be treated in the strictest confidence.

Yours sincerely,

IVOR DAVIES

ID/emw

(Lecturer in Geography)

Job No. 1 2 3 — 0 0 4

Serial No. 4 5 6 7 8 9 10 11 12 13

LAKEHEAD UNIVERSITY

DEPARTMENT OF GEOGRAPHY

CONSUMER SURVEY

Interviewer's Name : _____

Student at : _____

Location Data : District

Thunder Bay 1

Rainy River 2

Kenora 3

Settlement Set : 1 2 3 4 5

Name of Town _____

House No. _____ Street Name _____

Name of Township _____

Lot No. _____ Concession No. _____

Date Day Time

1st Visit

2nd Visit

3rd Visit

Hello. My name is _____. I am working for the Department of Geography, Lakehead University and I am taking a survey of shopping habits of people in Northwestern Ontario. I would like you to answer some questions. All your answers will be treated in strictest confidence.

1a. "In what town/village did you last buy?"

(Circle Appropriate No.)	Men's work clothes	Women's shoes	Men's shoes	Teenage girls' clothes	Children's clothes	Men's coat	Women's coat	Drugs	Groceries	Meat
	14	15	16	17	18	19	20	21	22	23
Set 1										
Port Arthur	1	1	1	1	1	1	1	1	1	1
Fort William	2	2	2	2	2	2	2	2	2	2
Kakabeka Falls	3	3	3	3	3	3	3	3	3	3
Nipigon	4	4	4	4	4	4	4	4	4	4
Schreiber	5	5	5	5	5	5	5	5	5	5
Terrace Bay	6	6	6	6	6	6	6	6	6	6
Marathon	7	7	7	7	7	7	7	7	7	7
Manitouwadge	8	8	8	8	8	8	8	8	8	8
Red Rock	9	9	9	9	9	9	9	9	9	9
Catalogue	0	0	0	0	0	0	0	0	0	0
Not applicable	11-	11-	11-	11-	11-	11-	11-	11-	11-	11-
Other	&	&	&	&	&	&	&	&	&	&
As specified	___	___	___	___	___	___	___	___	___	___

1b. "In what town/village do you buy most?"

(Circle Appropriate No.)	Men's work clothes	Women's shoes	Men's shoes	Teenage girls' clothes	Children's clothes	Men's coats	Women's coats	Drugs	Groceries	Meat
	24	25	26	27	28	29	30	31	32	33
Set 1										
Port Arthur	1	1	1	1	1	1	1	1	1	1
Fort William	2	2	2	2	2	2	2	2	2	2
Kakabeka Falls	3	3	3	3	3	3	3	3	3	3
Nipigon	4	4	4	4	4	4	4	4	4	4
Schreiber	5	5	5	5	5	5	5	5	5	5
Terrace Bay	6	6	6	6	6	6	6	6	6	6
Marathon	7	7	7	7	7	7	7	7	7	7
Manitouwadge	8	8	8	8	8	8	8	8	8	8
Red Rock	9	9	9	9	9	9	9	9	9	9
Catalogue	0	0	0	0	0	0	0	0	0	0
Not applicable	11-	11-	11-	11-	11-	11-	11-	11-	11-	11-
Other	&	&	&	&	&	&	&	&	&	&
As specified	___	___	___	___	___	___	___	___	___	___

2. "When you decide what town to shop in for a coat for yourself which of the following do you consider to be most important?" *(Show card A.)*

Price	1		34
Choice/Selection	2		
Quality	3	*(Circle Appropriate No.)*	
Parking	4		
Service in stores there	5		
Opportunity to take a trip	6		
No opinion	7		
Other	8		

If other - ask respondent to be specific. _____

3. "In what town did you last buy?"

(Circle Appropriate No.)	Television set	Refrigerator	Furniture	Watch	Jewellery	Car	Farm machinery
	35	36	37	38	39	40	41
Set 1							
Port Arthur	1	1	1	1	1	1	1
Fort William	2	2	2	2	2	2	2
Kakabeka Falls	3	3	3	3	3	3	3
Nipigon	4	4	4	4	4	4	4
Schreiber	5	5	5	5	5	5	5
Terrace Bay	6	6	6	6	6	6	6
Marathon	7	7	7	7	7	7	7
Manitouwadge	8	8	8	8	8	8	8
Red Rock	9	9	9	9	9	9	9
Catalogue	0	0	0	0	0	0	0
Not applicable	11-	11-	11-	11-	11-	11-	11-
Other	&	&	&	&	&	&	&
As specified	___	___	___	___	___	___	___

4. "When you decided what town to go to to buy your car what thing was most important in choosing that town?"

Particular model available there	1		42
Dealer has a good reputation	2		
Price/Bargain buy	3	*(Circle*	
Selection	4	*Appropriate*	
Quality of car	5	*No.)*	
After-sale service	6		
Other	7		
No opinion	8		

i. *If other - ask respondent to be specific.* _____

_____

5i. "Have you bought anything by catalogue in the last month?"

Yes	1	43
No	2	

ii. *If yes:* "What was the last good you bought in the last month?"

Furniture	1		44
Appliance	2		
Work clothing	3		
Fashion clothing (Adults)	4	*(Circle*	
Children's clothing	5	*Appropriate*	
Sporting good	6	*No.)*	
Shoes	7		
Household fittings	8		
Other _____	9		

_____

6i. *If no to* 5i.: "Do you ever buy by catalogue?"

Yes	1	45
No	2	

ii. *If yes to* 5ii. *or* 6i.: "Why do you use catalogues to shop?"

Goods not available locally	1		46
Saves travelling	2		
Selection	3	*(Circle*	
Price	4	*Appropriate*	
Money Back Guarantee	5	*No.)*	
No reason	6		
Other _____	7		

_____

7a. "In what town did you last?"

(Circle Appropriate No.)	see a family doctor	see a medical specialist	see a dentist	see a lawyer	see about car insurance	see an optometrist	visit a bank	visit a hospital
	47	48	49	50	51	52	53	54
Set 1								
Port Arthur	1	1	1	1	1	1	1	1
Fort William	2	2	2	2	2	2	2	2
Kakabeka Falls	3	3	3	3	3	3	3	3
Nipigon	4	4	4	4	4	4	4	4
Schreiber	5	5	5	5	5	5	5	5
Terrace Bay	6	6	6	6	6	6	6	6
Marathon	7	7	7	7	7	7	7	7
Manitouwadge	8	8.	8	8	8	8	8	8
Red Rock	9	9	9	9	9	9	9	9
By post				0	0		0	
Not applicable	11-	11-	11-	11-	11-	11-	11-	11-
Other	&	&	&	&	&	&	&	&
As specified	___	___	___	___	___	___	___	___

7b. "In what town do you usually?"

(Circle Appropriate No.)	see a family doctor	see a medical specialist	see a dentist	see a lawyer	see about car insurance	see an optometrist	visit a bank	visit a hospital
	55	56	57	58	59	60	61	62
Set 1								
Port Arthur	1	1	1	1	1	1	1	1
Fort William	2	2	2	2	2	2	2	2
Kakabeka Falls	3	3	3	3	3	3	3	3
Nipigon	4	4	4	4	4	4	4	4
Schreiber	5	5	5	5	5	5	5	5
Terrace Bay	6	6	6	6	6	6	6	6
Marathon	7	7	7	7	7	7	7	7
Manitouwadge	8	8	8	8	8	8	8	8
Red Rock	9	9	9	9	9	9	9	9
By post				0	0		0	
Not applicable	11-	11-	11-	11-	11-	11-	11-	11-
Other	&	&	&	&	&	&	&	&
As specified	___	___	___	___	___	___	___	___

8. "Which of these towns did you last visit in the last 12 months to do shopping?" *(Show card B.)*

Winnipeg	1		63
Toronto	2		
Duluth/Superior	3		
International Falls	4	*(Circle*	
Minneapolis/St. Paul	5	*Appropriate*	
Montreal	6	*No.)*	
Sudbury	7		
Sault Ste. Marie	8		
Timmins	9		
None of them	0		

9i. "In what town do you do most of your shopping in winter?"

_____

Set 1

Port Arthur	1		64
Fort William	2		
Kakabeka Falls	3		
Nipigon	4		
Schreiber	5	*(Circle*	
Terrace Bay	6	*Appropriate*	
Marathon	7	*No.)*	
Manitouwadge	8		
Red Rock	9		
Catalogue	0		
Not applicable	11-		
Other	&		

As specified _____

ii. "In what town do you do most of your shopping in summer?"

_____

Set 1

Port Arthur	1		65
Fort William	2		
Kakabeka Falls	3		
Nipigon	4		
Schreiber	5	*(Circle*	
Terrace Bay	6	*Appropriate*	
Marathon	7	*No.)*	
Manitouwadge	8		
Red Rock	9		
Catalogue	0		
Not applicable	11-		
Other	&		

As specified _____

iii. "What means of transport do you use to shop in towns/villages outside of this one in winter?" _____

Foot	1		66
Horse	2		
Car	3		
Truck	4		
Snowmobiles	5	*(Circle*	
Boat	6	*Appropriate*	
Bus	7	*No.)*	
Bus (Co.)	8		
Train	9		
Plane	0		
Taxi	11-		
Combination	&		

iv. "What means of transport do you use to shop in towns/villages outside of this one in summer?" _____

Foot	1		67
Horse	2		
Car	3		
Truck	4		
Snowmobiles	5	*(Circle*	
Boat	6	*Appropriate*	
Bus	7	*No.)*	
Bus (Co.)	8		
Train	9		
Plane	0		
Taxi	11-		
Combination	&		

10. *If the same town is named in* 9i. *and* 9ii. *ask:*

i. "Do you cut down on your number of trips in winter?"

Yes	1	68
No	2	

ii. *If yes, ask:* "Why?" _____

_____

For office use

Travelling is more dangerous	1		69
Takes longer (state of roads)	2		
Too cold	3	*(Circle*	
Car is laid up for winter	4	*Appropriate*	
Have other things to do in winter	5	*No.)*	
No real reason	6		
Other _____	7		

OR

If different towns are named in 9i. *and* 9ii. *ask:*

iii. "Why do you do most of your shopping in _____ (name town in 9i.) in winter when you do most of your shopping in summer in _____ (name town in 9ii.)?"

For office use

Travelling is more dangerous	1		70
Takes longer (state of roads)	2		
Too cold	3	*(Circle Appropriate No.)*	
Car is laid up for winter	4		
Have other things to do in winter	5		
No real reason	6		
Other _____	7		

"Now to help us study these results, I would like you to answer some questions about yourself."

11. *(By observation)* Respondent is Male 1 71

Female

12. "In what country were you born?" _____

Canada	1	
Great Britain	2	
Holland/Netherlands	3	
Finland	4	
U.S.S.R. (Ukraine)	5	*(Circle Appropriate No.)*
Germany	6	
France	7	
Italy	8	
Czechoslovakia	9	
Poland	0	
Does not know	11-	
Other _____	&	

Write in Name of Country

13. "In what year were you born?" _____

Write in Year

For office use

15 - 19	1		73
20 - 40	2	*(Circle Appropriate No.)*	
40 - 60	3		
60+	4		
Does not know	5		
Refused			

14. "In what year did you come to live in this town/village/township?" _____
Write in Year

For office use

1 year or less	1		74
1 - 4	2		
5 - 10	3	*(Circle Appropriate No.)*	
More than 10 years	4		
Born here	5		
No information	6		

15. "What was the main reason you came to live in this town/village/township?" *(Write reason in space)* _____

_____

For office use

Had a job to come to	1		75
Housing	2		
Land available	3		
Friends/Relatives here	4		
Community here of same ethnic origin	5	*(Circle Appropriate No.)*	
Likes the area (N.W. Ontario)	6		
Climate	7		
Resembles homeland	8		
Didn't want to live in large city	9		
No preference	0		
Other	11-		

16. "To what ethnic group do you belong; e.g. Canadian, British, Finnish?" _____

For office use

Canadian	1		76
British	2		
Finnish	3		
Ukrainian	4		
Polish	5	*(Circle*	
German	6	*Appropriate*	
French	7	*No.)*	
Italian	8		
Slovakian	9		
Dutch	0		
Does not know	11-		
Other _____ *Write in*	&		

17. "What type of work do you do?" _____

_____

For office use

Professional	1		77
Managerial	2		
Clerical	3		
Trade	4		
Semi-Skilled	5	*(Circle*	
Unskilled	6	*Appropriate*	
Continuing Education	7	*No.)*	
Continuing Training	8		
Unemployed	9		
Retired	0		
Does not work	11-		

18. "In what industry do you work?" _____

_____

N.B. Not the name of the firm.

For office use

Agriculture	1		78
Forestry	2		
Fishing and Trapping	3		
Mines (and quarrying)	4		
Manufacturing	5	*(Circle*	
Construction	6	*Appropriate*	
Transportation	7	*No.)*	
Trade	8		
Finance Insurance Real Estate	9		
Service	0		
Administration and Defence	11-		
Does not work	&		

19. "In what town/village/township do you work?" _____

_____

20. "How long does it take you to get to your place of work from this house?"

Time - _____

For office use

Less than 15 minutes	1		79
15 minutes - 29 minutes	2		
30 minutes - 44 minutes	3	*(Circle*	
45 minutes - 59 minutes	4	*Appropriate*	
60 minutes - 90 minutes	5	*No.)*	
90 minutes +	6		
Does not know	7		

21. "How do you get to work?"

Car	1		80
Bus (Co.)	2	*(Circle*	
Bus	3	*Appropriate*	
Train	4	*No.)*	
Foot	5		
Bicycle	6		

22. "What was the highest grade you completed at school or university?" _____

For office use

Grade 1 - 5	1		14
Grade 6 - 9	2		
Grade 10 - 13	3		
Diploma	4	*(Circle*	
Bachelor's Degree	5	*Appropriate*	
Master's Degree	6	*No.)*	
Ph.D.	7		
Educated Abroad	8		

23. "Have you received any training since leaving school?"

Yes	1
No	2

24. *If yes:* "Would you please describe this training?"

_____

_____

_____

For office use

Trade	1		15
Service	2		
Professional	3	*(Circle*	
Managerial	4	*Appropriate*	
Commercial	5	*No.)*	
Other	6		

25. "Would you please tell me into which of these five categories your income falls?" *(Show card C.)*

Below 3,000	1		16
3,000 - 5,999	2		
6,000 - 8,999	3	*(Circle*	
9,000 - 12,000	4	*Appropriate*	
12,000 +	5	*No.)*	
Refused	6		

26. "Are you married or single?"

Single	1
Married	2

If single, proceed to question 39.
If married, continue with question 27.

27. "In what country was your wife/husband born?" _____

Canada	1		17
Great Britain	2		
Holland/Netherlands	3		
Finland	4		
U.S.S.R. (Ukraine)	5	*(Circle*	
Germany	6	*Appropriate*	
France	7	*No.)*	
Italy	8		
Czechoslovakia	9		
Poland	0		
Does not know	11-		
Other _____	&		

Write in Name of Country

28. "In what year was your husband/your wife born?" _____

Write in Year

For office use

15 - 19	1		18
20 - 39	2		
40 - 59	3	*(Circle* *Appropriate* *No.)*	
60+	4		
Does not know	5		

29. "To what ethnic group does your husband/your wife belong?"

Canadian	1		19
British	2		
Finnish	3		
Ukrainian	4		
Polish	5	*(Circle*	
German	6	*Appropriate*	
French	7	*No.)*	
Italian	8		
Slovakian	9		
Dutch	0		
Does not know	11-		
Other _____	&		
Write in			

30. "What type of work does your husband/your wife do?"

For office use

Professional	1		20
Managerial	2		
Clerical	3		
Trade	4	*(Circle*	
Semi-Skilled	5	*Appropriate*	
Unskilled	6	*No.)*	
Continuing Education	7		
Continuing Training	8		
Unemployed	9		
Retired	0		
Does not work	11-		

31. "In what industry does your husband/your wife work?"

N.B. Not the name of the firm.

For office use

Agriculture	1		21
Forestry	2		
Fishing and Trapping	3		
Mines (and quarrying)	4		
Manufacturing	5	*(Circle*	
Construction	6	*Appropriate*	
Transportation	7	*No.)*	
Trade	8		
Finance Insurance Real Estate	9		
Service	0		
Administration and Defence	11-		
Does not work	&		

32. "In what town/village/township does your husband/wife work?"

_____

33. "How long does it take your husband/your wife to get to work from this house?"

Time - _____

For office use

Less than 15 minutes	1		22
15 minutes - 29 minutes	2		
30 minutes - 44 minutes	3	*(Circle*	
45 minutes - 59 minutes	4	*Appropriate*	
60 minutes - 90 minutes	5	*No.)*	
90 minutes +	6		
Does not know	7		

34. "How does your husband/your wife get to work?"

Car	1		23
Bus (Co.)	2	*(Circle*	
Bus	3	*Appropriate*	
Train	4	*No.)*	
Foot	5		
Bicycle	6		

35. "What was the highest grade your husband/wife completed at school or university?" _____

Grade 1 - 5	1		24
Grade 6 - 9	2		
Grade 10 - 13	3		
Diploma	4	*(Circle*	
Bachelor's Degree	5	*Appropriate*	
Master's Degree	6	*No.)*	
Ph.D.	7		
Educated Abroad	8		

36. "Has your husband/your wife received any training since leaving school?"

Yes	1
No	2

37. *If yes:* "Would you please describe this training?"

_____

_____

_____

For office use

Trade	1		25
Service	2		
Professional	3	*(Circle*	
Managerial	4	*Appropriate*	
Commercial	5	*No.)*	
Other	6		

38. "Would you please tell me into which of these five categories your wife's/your husband's income falls?" *(Show card C.)*

Below 3,000	1		26
3,000 - 5,999	2		
6,000 - 8,999	3	*(Circle*	
9,000 - 12,000	4	*Appropriate*	
12,000 +	5	*No.)*	
Refused	6		

Ask all respondents questions 39-48, if applicable.

39. "Would you please tell me into which of these five categories your total family income falls?" *(Show card C again.)*

Below 3,000	1		27
3,000 - 5,999	2		
6,000 - 8,999	3	*(Circle*	
9,000 - 12,000	4	*Appropriate*	
12,000 +	5	*No.)*	
Refused	6		

40. "In what month does winter begin?"

September	1		28
October	2	*(Circle*	
November	3	*Appropriate*	
December	4	*No.)*	
Unable to say	5		

41. "Why do you believe that winter begins in _____?"
Name Month

Write down reasons. _____
_____
_____

For office use

Temperature	1		29
Snow storms	2		
Snow	3		
Frost	4		
Cold winds	5	*(Circle*	
Cloud	6	*Appropriate*	
Sunshine	7	*No.)*	
Ice on lakes/bays/rivers	8		
Clothing	9		
Heating bills up	0		
Other	11-		

42. "In what month does winter end?"

February	1		30
March	2		
April	3	*(Circle*	
May	4	*Appropriate*	
June	5	*No.)*	
Unable to say	6		

43. "Why do you believe that winter ends in _____?"
Name Month

Write down reasons. _____

_____

_____

For office use

Temperature	1		31
Snow melts	2		
No frost	3		
Plant growth	4	*(Circle*	
Ice melts	5	*Appropriate*	
Frost ceases	6	*No.)*	
Light clothing	7		
Heating bills down	8		
Other	9		

44. "In what country did you receive most of your education?"

_____

For office use

Canada	1		32
Great Britain	2		
Holland/Netherlands	3		
Finland	4		
U.S.S.R. (Ukraine)	5	*(Circle*	
Germany	6	*Appropriate*	
France	7	*No.)*	
Italy	8		
Czechoslovakia	9		
Poland	0		
Does not know	11-		
Other	&		

If applicable.

45. "In what country did your husband/wife receive most of his/her education?" _____

For office use

Canada	1		33
Great Britain	2		
Holland/Netherlands	3		
Finland	4	*(Circle*	
U.S.S.R. (Ukraine)	5	*Appropriate*	
Germany	6	*No.)*	
France	7		
Italy	8		
Czechoslovakia	9		
Poland	0		
Does not know	11-		
Other	&		

46. "What language is used most in the home?" _____

For office use

English	1		34
Indian	2		
Finnish	3		
Ukrainian	4	*(Circle*	
Polish	5	*Appropriate*	
German	6	*No.)*	
French	7		
Italian	8		
Slovakian	9		
Dutch	0		
Does not know	11-		
Other	&		

47i. "Where did you live before moving to this town/village/township?"

Always lived here	1	35
Other Northwestern Ontario	2	

ii. *If* 2-12: "Where did you live before that?"

Always lived here	1	36
Other Northwestern Ontario	2	

48i. "Do you have definite plans to move from this town/village/township?"

Yes	1	37
No	2	

If yes:

ii. "To what town/village/township will you be moving?"

_____

For office use

Other N.W. Ontario (rural)	1		38
Other N.W. Ontario (urban)	2		
Other Ontario	3		
British Columbia	4		
Prairie Provinces	5	*(Circle*	
Quebec	6	*Appropriate*	
Maritimes	7	*No.)*	
Other Canada	8		
Europe	9		
U.S.A.	0		
Other	11-		

iii. "When will you be moving?" _____ _____ 39
Month *Year*

iv. "Why will you be moving?" _____

For office use

Here temporarily	1		40
Dissatisfied with working conditions	2		
Dissatisfied with earnings	3		
Dissatisfied with cost of living	4	*(Circle*	
Dissatisfied with housing	5	*Appropriate*	
Dissatisfied with services	6	*No.)*	
Dissatisfied with social atmosphere	7		
Being transferred	8		
No employment opportunities	9		
Other places more attractive	0		

At conclusion of interview

	Outcome	
Respondent contacted on visit	*Answered*	*Refused*
1	1	2
2	1	2
3	1	2

"Was linguistic communication between respondent and yourself?":

Excellent	1
Good	2
Fair	3
Poor	4

APPENDIX 6

PRIMARY AND SECONDARY SETTLEMENT SETS: DISTANCES (in miles)

PRIMARY SET 1

No.	Name	PA*	FW	KF	Nip	Schr	TB	Mar	Man	RRo
1	PA	.0	2.9	17.6	59.2	113.6	121.6	171.6	224.0	56.0
2	FW	3.8	.0	16.0	67.2	121.6	129.6	179.2	232.0	64.0
3	KF	17.6	16.0	0.0	--	--	--	--	--	--
4	Nip	59.2	67.2	--	.0	54.4	63.4	112.0	164.8	11.2
5	Schr	113.6	121.6	--	54.4	0.0	8.0	57.6	110.4	65.6
6	TB	121.6	129.6	--	62.4	8.0	0.0	49.6	102.4	73.6
7	Mar	171.2	179.2	--	112.0	57.6	49.6	0.0	60.8	123.2
8	Man	224.0	232.0	--	164.8	110.4	102.4	60.8	0.0	176.0
9	RRo	56.0	64.0	--	11.2	65.6	73.6	123.2	176.0	0.0
0	Cat	0.0	0.0	--	0.0	0.0	0.0	0.0	0.0	0.0

*

PA	Port Arthur
FW	Fort William
KF	Kakabeka Falls
Nip	Nipigon
Schr	Schreiber
TB	Terrace Bay
Mar	Marathon
Man	Manitouwadge
RRo	Red Rock

SECONDARY SET 1

No.	Name	HB*	HBS	Arm	Dor	Rsp	J.Gd	Mur	VH	Rsl
1	PA	127.2	130.4	160.4	36.3	97.6	0.0	12.6	8.2	9.8
2	FW	135.2	138.4	168.4	44.3	105.6	3.9	10.0	1.5	3.6
3	KF							7.5	14.6	9.9
4	Nip	117.6	120.8	139.5	22.8	38.4				
5	Schr	63.2	66.4	22.8						
6	TB	55.2	58.4	38.4						
7	Mar	8.8	12.0							
8	Man	52.8	56.0							
9	RRo	128.8	132.0	137.3	19.6					
0	Cat	0.0	0.0	0.0	0.0					

*

HB	Heron Bay
HBS	Heron Bay South
Arm	Armstrong
Dor	Dorion
Rsp	Rossport
J.Gd	Jumbo Gardens
Mur	Murillo
VH	Vickers Heights
Rsl	Rosslyn

PRIMARY SET 2

No.	Name	Bear *	Ger	Long	Nak
1	PA	107.6	157.2	174.0	195.6
2	FW	115.6	165.2	182.0	203.6
3	Nip	46.4	96.5	194.8	134.9
4	Bear	0.0	49.6	67.6	61.2
5	Ger	49.6	0.0	22.8	36.8
6	Long	67.6	22.8	0.0	61.2
7	Nak	61.2	36.8	61.2	0.0
8	Sud	--	--	--	--
9	SSM	--	--	--	--
0	Cat	0.0	0.0	0.0	0.0

*

Bear	Beardmore
Ger	Geraldton
Long	Longlac
Nak	Nakina
Sud	Sudbury
SSM	Sault Ste. Marie

SECONDARY SET 2

No.	Name	Jellicoe	Macdiarmid	Cameron Falls
1	PA	127.2	94.0	69.4
2	FW	135.2	102.0	77.4
3	Nip	66.0	22.8	12.0
4	Bear	19.6	13.6	--
5	Ger	28.0	63.7	--
6	Long	46.0	81.7	--
7	Nak			--
8	Sud	--	--	--
9	SSM	--	--	--
0	Cat	0.0	0.0	0.0

PRIMARY SET 3

No.	Name	Ken *	Kee	Ignce	Up	SL	Dry
1	PA	290.9	295.7	140.8	75.4	231.6	207.8
2	FW	295.9	300.7	145.8	80.4	236.6	212.8
3	Ken	0.0	3.2	146.6	214.2	102.1	82.4
4	Kee	3.2	0.0	151.4	219.0	106.8	87.1
5	Ignce	146.6	151.4	219.0	64.6	90.0	66.2
6	Up	214.2	219.0	117.1	0.0	155.4	131.6
7	W	121.0	117.1	106.8	336.8	267.4	205.0
8	SL	102.1	106.8	90.0	155.4	0.0	61.6
9	Dry	82.4	87.1	66.2	131.6	61.6	0.0
0	Cat	0.0	0.0	0.0	0.0	0.0	0.0

*

Ken	Kenora
Kee	Keewatin
Ignce	Ignace
Up	Upsala
W	Winnipeg
SL	Sioux Lookout
Dry	Dryden

SECONDARY SET 3

No.	Name	Bor.C *	Din	Barc	Ox	ER	Gu	Redd	Rab.L	JM	VB	Rai
1	PA	178.3	190.1	201.9	216.1	220.4	230.3	317.9	293.7	295.6	234.6	48.4
2	FW	183.3	195.1	206.9	221.1	225.4	235.3	322.9	298.7	300.6	239.6	53.4
3	Ken	113.1	101.3	89.1	74.9	75.7	60.3	16.2	2.0	3.9	55.6	242.9
4	Kee	117.8	106.0	93.8	79.6	76.5	65.0	17.8	3.6	5.5	60.3	246.9
5	Ignce	36.6	48.5	60.3	74.5	78.8	88.5	163.6	149.4	151.3	93.0	92.0
6	Up	102.0	112.9	125.7	139.9	144.2	154.1	231.2	217.0	218.9	158.4	26.6
7	W	235.7	223.9	211.7	197.5	193.6	182.9	135.7	121.5	123.4	178.2	364.7
8	SL	55.3	42.7	55.7	69.9	74.2	84.1	119.1	104.9	106.8	88.4	182.8
9	Dry	29.9	18.1	5.9	7.5	12.6	22.5	99.4	85.2	87.1	26.0	159.0
0	Cat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

*

Bor.C	Borups Corners	ER	Eagle River	JM	Jaffray-Melick
Din	Dinorwic	Gu	Gunne	VB	Vermilion Bay
Barc	Barclay	Redd	Reddit	Rai	Raith
Ox	Oxdrift	Rab.L	Rabbit Lake		

PRIMARY SET 4

No.	Name	FF *	Emo	RR	At
1	PA	212.0	233.8	268.4	121.8
2	FW	217.0	238.8	273.4	126.8
3	FF	0.0	19.8	54.4	93.4
4	Emo	19.8	0.0	34.0	115.2
5	RR	54.4	34.0	0.0	151.4
6	W	238.3	197.9	163.9	333.7
7	IF	.4	21.4	56.0	95.3
8	At	93.4	115.2	151.4	0.0
9	Ken	129.8	108.0	135.9	225.2
0	Cat	0.0	0.0	0.0	0.0

*

FF	Fort Frances
Emo	Emo
RR	Rainy River
W	Winnipeg
IF	International Falls
At	Atikokan
Ken	Kenora

SECONDARY SET 4

No.	Name	SN *	NF	Barw	Str	Pine	Slee	Dev	LV
1	PA	296.3	271.7	240.5	248.7	255.9	261.7	225.8	224.2
2	FW	301.3	276.7	245.5	253.7	260.9	266.7	230.8	229.2
3	FF	82.5	57.7	26.6	34.7	41.9	47.7	11.8	10.2
4	Emo	63.0	35.9	6.3	14.4	21.7	27.4	7.9	10.2
5	RR	91.0	63.8	27.6	19.5	12.2	6.3	42.4	44.6
6	W	165.9	193.1	191.6	183.4	175.5	170.0	216.2	208.5
7	IF	83.2	58.4	28.2	36.3	43.5	49.3	13.4	10.4
8	At	177.9	152.1	121.9	129.1	137.3	143.1	107.2	105.6
9	Ken	44.9	72.1	84.9	92.8	100.1	106.0	116.2	118.6
0	Cat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

*

SN	Sioux Narrows
NF	Nestor Falls
Barw	Barwick
Str	Stratton
Pine	Pinewood
Slee	Sleeman
Dev	Devlin
LV	La Vallee

PRIMARY SET 5

No.	Name	RL *	Balm	Mad	Coch	EF
1	PA	381.2	382.2	387.2	387.7	332.6
2	FW	386.2	387.2	392.2	392.7	337.7
3	RL	0.0	6.3	5.9	10.2	48.2
4	W	295.0	297.0	301.5	301.5	246.3
5	Balm	6.3	0.0	4.3	4.3	49.2
6	Mad	5.9	12.3	0.0	16.4	54.2
7	Coch	10.2	4.3	16.4	0.0	54.7
8	Dry	133.4	135.4	139.4	139.9	84.7
9	EF	48.2	49.2	54.2	54.7	0.0
0	Cat	0.0	0.0	0.0	0.0	0.0

*

RL	Red Lake
Balm	Balmertown
Mad	Madsen
Coch	Cochenour
Dry	Dryden
EF	Ear Falls

APPENDIX 7

HIGH SCHOOLS PARTICIPATING IN THE SAMPLE SURVEY

FORT WILLIAM

Fort William Collegiate Institute: William Osborne, Esq.*

Selkirk Collegiate and Vocational Institute: Jack McLean, Esq.

Westgate High School: William R. Seeley, Esq.

PORT ARTHUR

Hammarskjold High School: Richard Manser, Esq.

Hillcrest High School: Brian Sheils, Esq.

Lakeview High School: Campbell McGregor, Esq.

Port Arthur Collegiate Institute: Brian Whitfield, Esq.

DISTRICTS

Terrace Bay High School: Ken MacLeod, Esq.

Marathon High School: J. Korkola, Esq.

Manitouwadge High School: R.D. Bailey, Esq.

Queen Elizabeth District High School, Kenora: John Madison, Esq.

Red Lake District High School: J.P. Rogan, Esq.

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*Head, Department of Geography, and coordinator of sample survey.

APPENDIX 8

NORTHWESTERN ONTARIO NUCLEATED POPULATIONS: DATA FOR FIGURES 3.7 & 3.8

Item	Atikokan % H.S.*	Balmertown % H.S.	Beardmore % H.S.
Mwc	83.8 +/- 12.9	47.4 +/- 22.5	75.0 +/- 30.0
Ws	67.7 +/- 16.1	28.8 +/- 23.7	50.0 +/- 34.6
Ms	79.4 +/- 13.6	31.3 +/- 22.7	50.0 +/- 31.0
Tgc	60.0 +/- 96.0	40.0 +/- 42.9	0.0
Cc	75.0 +/- 17.0	57.1 +/- 25.9	33.4 +/- 37.7
Mc	66.6 +/- 16.1	25.0 +/- 21.2	33.3 +/- 30.8
Wc	66.6 +/- 16.9	18.8 +/- 19.1	10.0 +/- 18.6
Dru	88.8 +/- 10.3	0.0	54.5 +/- 29.4
Groc	97.2 +/- 5.2	65.0 +/- 20.9	58.3 +/- 27.9
Meat	94.4 +/- 7.4	68.4 +/- 20.9	50.0 +/- 28.3
TV	71.4 +/- 14.9	63.2 +/- 21.7	54.5 +/- 29.4
Refr	67.6 +/- 15.7	37.5 +/- 23.7	9.0 +/- 17.0
Furn	71.8 +/- 15.6	20.0 +/- 20.2	27.2 +/- 26.3
Wa	51.4 +/- 16.5	33.3 +/- 21.8	58.3 +/- 27.9
Jew	59.3 +/- 17.0	64.7 +/- 22.7	66.6 +/- 30.8
Car	39.3 +/- 16.7	5.3 +/- 10.0	9.0 +/- 17.7
FD	86.1 +/- 11.3	70.0 +/- 20.1	50.0 +/- 28.3
MSp	31.0 +/- 16.8	12.5 +/- 16.2	0.0
Dent	77.7 +/- 13.6	78.9 +/- 18.3	0.0
Law	55.0 +/- 21.8	0.0	0.0
CI	90.6 +/- 10.1	15.8 +/- 16.4	0.0
Opt	28.5 +/- 16.7	0.0	0.0
Bank	100.0 +/- 3.3	95.0 +/- 9.6	91.6 +/- 15.6
Hos	84.3 +/- 12.6	0.0	54.5 +/- 29.4

*This percentage is based on all those obtaining an item either in the home-settlement or by travel. It does not, therefore, always correspond to the percentage for home-town purchase shown in Appendix 17, which is based on those obtaining an item in a specified place or by catalogue.

Item	Dryden % H.S.	Emo % H.S.	Fort Frances % H.S.
Mwc	82.2 +/- 7.9	55.5 +/- 32.4	73.0 +/- 12.0
Ws	74.7 +/- 9.1	40.0 +/- 30.4	66.6 +/- 12.9
Ms	83.8 +/- 7.5	50.0 +/- 31.0	84.4 +/- 9.5
Tgc	67.8 +/- 17.3	0.0	82.0 +/- 12.0
Cc	89.8 +/- 7.8	50.0 +/- 40.0	91.4 +/- 9.2
Mc	80.6 +/- 8.0	44.4 +/- 32.5	92.1 +/- 7.4
Wc	71.7 +/- 9.2	20.0 +/- 24.8	83.3 +/- 9.9
Dru	98.1 +/- 2.6	84.6 +/- 19.4	83.3 +/- 9.0
Groc	97.1 +/- 3.2	76.9 +/- 22.9	92.4 +/- 6.4
Meat	98.1 +/- 2.6	76.9 +/- 22.9	87.6 +/- 8.0
TV	83.0 +/- 7.4	54.5 +/- 29.4	82.5 +/- 9.3
Refr	77.7 +/- 8.2	42.0 +/- 27.9	82.5 +/- 8.4
Furn	79.8 +/- 7.8	27.0 +/- 26.2	88.8 +/- 7.7
Wa	73.3 +/- 9.1	55.5 +/- 32.4	80.6 +/- 9.8
Jew	79.8 +/- 8.3	11.1 +/- 20.4	88.5 +/- 8.0
Car	73.9 +/- 9.0	30.0 +/- 28.4	81.9 +/- 9.6
FD	98.1 +/- 2.7	84.6 +/- 19.4	86.5 +/- 8.1
MSp	36.0 +/- 13.3	0.0	20.0 +/- 11.7
Dent	95.0 +/- 4.2	0.0	74.6 +/- 10.4
Law	91.5 +/- 6.5	0.0	97.7 +/- 4.3
CI	92.3 +/- 7.8	80.0 +/- 24.8	70.1 +/- 11.9
Opt	74.1 +/- 9.3	8.3 +/- 15.4	96.6 +/- 4.5
Bank	99.0 +/- 1.9	84.6 +/- 19.4	85.0 +/- 8.5
Hos	95.1 +/- 4.2	83.3 +/- 21.3	83.5 +/- 8.9

Item	Fort William % H.S.	Geraldton % H.S.	Keewatin % H.S.
Mwc	91.1 +/- 5.6	86.6 +/- 12.1	20.8 +/- 16.3
Ws	87.5 +/- 6.0	60.0 +/- 17.5	0.0
Ms	90.0 +/- 5.3	82.8 +/- 12.5	13.7 +/- 12.6
Tgc	88.4 +/- 8.8	75.0 +/- 30.0	6.6 +/- 12.9
Cc	88.3 +/- 6.9	78.5 +/- 21.5	20.0 +/- 20.2
Mc	90.9 +/- 5.4	77.7 +/- 13.6	0.0
Wc	84.9 +/- 6.6	59.3 +/- 17.0	3.5 +/- 7.3
Dru	98.3 +/- 6.4	90.6 +/- 8.7	73.3 +/- 15.9
Groc	95.0 +/- 3.9	100.0 +/- 3.0	90.0 +/- 10.7
Meat	95.8 +/- 3.5	95.2 +/- 6.4	86.6 +/- 12.0
TV	68.6 +/- 8.5	73.1 +/- 13.5	23.3 +/- 15.1
Refr	66.9 +/- 8.5	67.5 +/- 14.5	20.6 +/- 14.8
Furn	63.5 +/- 8.7	68.2 +/- 14.2	7.1 +/- 9.5
Wa	86.9 +/- 6.1	74.3 +/- 13.7	7.1 +/- 9.5
Jew	91.7 +/- 5.1	75.8 +/- 15.6	3.4 +/- 6.2
Car	63.6 +/- 9.0	58.5 +/- 15.1	3.8 +/- 6.6
FD	97.5 +/- 2.5	90.6 +/- 8.7	80.0 +/- 14.3
MSp	80.9 +/- 8.4	0.0	5.0 +/- 9.6
Dent	93.0 +/- 4.7	83.7 +/- 11.0	0.0
Law	89.7 +/- 5.9	9.6 +/- 10.3	0.0
CI	85.7 +/- 6.4	76.1 +/- 12.8	48.1 +/- 18.8
Opt	93.6 +/- 4.8	32.4 +/- 15.1	0.0
Bank	97.4 +/- 3.1	93.0 +/- 7.6	75.0 +/- 16.0
Hos	99.1 +/- 1.8	88.0 +/- 9.8	3.3 +/- 6.1

Item	Kenora % H.S.	Longlac % H.S.	Manitouwadge % H.S.
Mwc	89.2 +/- 6.3	66.6 +/- 23.8	80.6 +/- 13.9
Ws	83.5 +/- 7.2	50.0 +/- 28.3	43.8 +/- 17.2
Ms	85.4 +/- 6.8	66.6 +/- 30.8	60.6 +/- 16.8
Tgc	54.9 +/- 13.7	100.0	58.3 +/- 27.9
Cc	75.0 +/- 11.0	66.6 +/- 30.8	81.8 +/- 16.1
Mc	78.9 +/- 8.2	28.5 +/- 23.6	50.0 +/- 17.3
Wc	71.7 +/- 8.9	33.3 +/- 26.6	43.3 +/- 17.7
Dru	100.0	52.9 +/- 23.7	94.3 +/- 7.7
Groc	100.0	76.4 +/- 20.1	97.3 +/- 5.2
Meat	100.0	76.4 +/- 20.1	91.9 +/- 8.8
TV	85.8 +/- 6.6	31.2 +/- 22.7	54.9 +/- 16.5
Refr	87.5 +/- 6.4	17.6 +/- 18.1	20.6 +/- 13.6
Furn	77.6 +/- 5.9	7.1 +/- 13.4	25.7 +/- 14.5
Wa	88.3 +/- 6.2	40.0 +/- 24.8	48.5 +/- 11.0
Jew	89.8 +/- 5.9	14.2 +/- 18.3	51.7 +/- 18.2
Car	73.2 +/- 8.8	7.1 +/- 13.4	48.5 +/- 17.0
FD	95.5 +/- 3.9	88.2 +/- 15.3	94.6 +/- 7.3
MSp	24.1 +/- 9.2	0.0	4.0 +/- 7.2
Dent	95.3 +/- 4.0	76.4 +/- 20.1	75.0 +/- 15.0
Law	96.6 +/- 3.8	0.0	0.0
CI	95.0 +/- 4.4	94.1 +/- 11.1	71.0 +/- 16.0
Opt	82.0 +/- 7.5	31.2 +/- 22.7	44.0 +/- 19.4
Bank	100.0	94.1 +/- 11.1	100.0 +/- 0.0
Hos	99.1 +/- 1.8	6.2 +/- 11.8	94.1 +/- 7.9

Item	Marathon % H.S.	Nipigon % H.S.	Nakina % H.S.
Mwc	72.0 +/- 14.1	75.0 +/- 17.3	33.4 +/- 37.7
Ws	35.0 +/- 18.0	19.2 +/- 15.1	33.4 +/- 37.7
Ms	41.3 +/- 17.6	53.6 +/- 18.5	0.0
Tgc	66.6 +/- 23.8	40.0 +/- 30.4	50.0 +/- 69.3
Cc	63.6 +/- 20.1	50.0 +/- 26.2	20.0 +/- 35.1
Mc	36.0 +/- 18.8	37.9 +/- 17.7	50.0 +/- 31.0
Wc	23.0 +/- 16.2	19.2 +/- 15.1	0.0
Dru	79.4 +/- 13.6	87.1 +/- 11.8	50.0 +/- 28.3
Groc	97.2 +/- 5.4	90.3 +/- 10.6	80.0 +/- 22.6
Meat	97.2 +/- 5.4	90.3 +/- 10.6	50.0 +/- 28.3
TV	50.0 +/- 17.3	69.0 +/- 16.8	37.5 +/- 33.5
Refr	52.6 +/- 18.1	43.3 +/- 17.7	12.5 +/- 22.9
Furn	36.4 +/- 16.4	34.5 +/- 17.2	28.6 +/- 33.7
Wa	53.3 +/- 17.8	71.4 +/- 16.8	0.0
Jew	21.4 +/- 15.2	53.8 +/- 19.2	0.0
Car	34.6 +/- 15.6	65.4 +/- 18.3	0.0
FD	82.3 +/- 12.5	64.5 +/- 16.8	0.0
MSp	0.0 +/- 10.0	8.3 +/- 10.9	0.0
Dent	80.0 +/- 13.6	0.0	0.0
Law	4.0 +/- 7.7	17.4 +/- 15.3	0.0
CI	64.5 +/- 16.8	61.5 +/- 18.7	0.0
Opt	5.8 +/- 7.8	3.7 +/- 7.4	10.0 +/- 18.6
Bank	97.2 +/- 5.4	83.9 +/- 12.9	0.0
Hos	77.1 +/- 13.9	77.4 +/- 14.7	0.0

Item	Port Arthur % H.S.	Rainy River % H.S.	Red Lake % H.S.
Mwc	94.5 +/- 3.8	80.0 +/- 17.5	83.3 +/- 14.9
Ws	95.8 +/- 4.1	68.4 +/- 20.9	73.6 +/- 19.1
Ms	94.4 +/- 3.9	90.0 +/- 13.1	90.0 +/- 13.1
Tgc	98.5 +/- 2.4	60.0 +/- 30.4	75.0 +/- 24.5
Cc	100.0	57.1 +/- 25.9	77.7 +/- 19.7
Mc	95.6 +/- 3.3	63.1 +/- 22.7	65.0 +/- 20.9
Wc	96.4 +/- 3.2	43.7 +/- 24.3	59.0 +/- 17.9
Dru	100.0	95.8 +/- 8.0	92.3 +/- 10.2
Groc	99.3 +/- 1.6	100.0	92.5 +/- 9.9
Meat	98.0 +/- 2.2	100.0	92.5 +/- 9.9
TV	84.4 +/- 5.9	78.2 +/- 16.9	62.5 +/- 19.4
Refr	91.1 +/- 4.6	79.1 +/- 16.3	48.0 +/- 19.6
Furn	85.4 +/- 5.7	45.4 +/- 20.8	60.0 +/- 19.2
Wa	83.2 +/- 6.2	59.0 +/- 20.6	84.0 +/- 14.4
Jew	86.5 +/- 5.6	63.1 +/- 22.3	88.0 +/- 12.7
Car	81.8 +/- 6.6	31.8 +/- 19.5	43.4 +/- 20.3
FD	94.1 +/- 3.8	54.1 +/- 19.9	92.5 +/- 9.9
MSp	88.4 +/- 5.8	5.8 +/- 11.1	52.9 +/- 23.7
Dent	93.8 +/- 3.9	0.0	81.4 +/- 14.7
Law	93.6 +/- 4.2	0.0	61.5 +/- 26.5
CI	88.4 +/- 5.6	90.9 +/- 12.0	81.8 +/- 16.1
Opt	91.6 +/- 4.6	0.0	83.3 +/- 17.2
Bank	96.7 +/- 2.7	100.0	100.0
Hos	97.9 +/- 2.3	69.5 +/- 18.8	92.0 +/- 5.4

Item	Red Rock % H.S.	Schreiber % H.S.	Sioux Lookout % H.S.
Mwc	41.7 +/- 18.5	66.7 +/- 26.6	86.6 +/- 12.2
Ws	22.2 +/- 15.6	66.7 +/- 26.6	79.3 +/- 14.7
Ms	29.6 +/- 16.8	83.3 +/- 21.0	83.3 +/- 13.3
Tgc	15.4 +/- 19.4	100.0	50.0 +/- 34.6
Cc	25.0 +/- 21.2	85.7 +/- 25.9	82.3 +/- 18.1
Mc	15.4 +/- 13.9	61.5 +/- 26.4	64.0 +/- 18.8
Wc	7.4 +/- 10.2	61.5 +/- 26.4	51.8 +/- 18.8
Dru	3.4 +/- 6.2	6.3 +/- 15.1	100.0 +/- 5.7
Groc	35.7 +/- 14.7	100.0	100.0
Meat	31.0 +/- 16.8	100.0	97.0 +/- 5.7
TV	55.2 +/- 18.1	68.8 +/- 22.7	69.2 +/- 17.7
Refr	41.4 +/- 17.9	64.3 +/- 24.1	62.9 +/- 18.2
Furn	28.6 +/- 16.8	63.6 +/- 28.3	44.0 +/- 19.4
Wa	20.8 +/- 17.6	69.2 +/- 25.1	72.0 +/- 17.6
Jew	12.0 +/- 12.7	45.5 +/- 29.4	66.6 +/- 17.8
Car	0.0	64.3 +/- 25.1	50.0 +/- 20.0
FD	59.3 +/- 18.6	62.5 +/- 23.6	84.8 +/- 13.4
MSp	0.0	0.0	10.5 +/- 13.8
Dent	44.4 +/- 18.7	56.3 +/- 24.3	58.6 +/- 15.6
Law	0.0	0.0	0.0
CI	40.7 +/- 18.5	100.0	70.8 +/- 18.2
Opt	0.0	18.8 +/- 19.1	21.7 +/- 16.8
Bank	96.0 +/- 7.7	100.0	100.0
Hos	0.0	0.0	100.0

Item	Terrace Bay % H.S.
Mwc	71.4 +/- 19.3
Ws	39.3 +/- 18.1
Ms	55.6 +/- 18.7
Tgc	45.5 +/- 29.9
Cc	77.8 +/- 19.2
Mc	37.9 +/- 17.7
Wc	31.0 +/- 16.8
Dru	90.3 +/- 10.4
Groc	100.0
Meat	96.8 +/- 6.2
TV	55.2 +/- 18.1
Refr	22.2 +/- 15.7
Furn	7.1 +/- 9.5
Wa	60.0 +/- 19.2
Jew	56.0 +/- 19.5
Car	13.8 +/- 12.6
FD	96.8 +/- 6.2
MSp	12.0 +/- 12.7
Dent	83.9 +/- 12.9
Law	6.3 +/- 11.9
CI	16.0 +/- 14.4
Opt	11.5 +/- 12.3
Bank	93.3 +/- 8.9
Hos	90.0 +/- 10.7

APPENDIX 9

SUMMARIES OF SERVICE PROVISION

ORDERING OF FUNCTIONAL TYPES

No. of occurrences			Functional Type	No. of Establishments		
NWO	LS	WS		NWO	LS	WS
49	25	24	Filling Station	223	138	85
47	24	23	Elementary School	138	91	47
43	19	24	Church	205	123	82
42	18	24	General Store	64	25	39
37	17	20	Food Store	306	233	73
30	16	14	Meeting Hall	109	72	37
31	14	17	Restaurant	201	141	64
28	17	11	Hotel	86	58	28
27	15	12	Motel	103	63	40
23	12	11	Barber Shop	99	69	30
23	11	12	Bank	58	37	21
23	11	12	Beautician	113	81	32
22	11	11	Local taxi service	54	36	18
20	12	8	Physician	184	141	43
20	11	9	Apparel store	137	97	40
21	11	10	Hardware Store	61	41	20
20	9	11	Insurance Agency	83	48	35
19	9	10	Theatre	23	13	10
19	10	9	Drug Store	45	30	15
19	11	8	Lumber Yard	47	31	16
18	8	10	Laundry (omat)	32	16	16
18	9	9	Variety Store	72	51	21
17	9	8	Billiards & Bowling	43	26	17

No. of occurrences			Functional Type	No. of Establishments		
NWO	LS	WS		NWO	LS	WS
17	8	9	Appliance Store	53	32	21
15	8	7	Auto Dealer	55	31	24
14	8	6	Department Store	28	17	11
14	8	6	High School	23	16	7
15	10	5	Credit Union	65	43	22
13	8	5	Dentist	59	45	14
15	8	7	Hospital & Clinic	27	17	10
15	9	6	Dry Cleaner	38	26	12
12	6	6	Freight line & Storage	36	21	15
12	8	4	Bulk Oil	21	15	6
9	4	5	Electric repair Shop	30	15	15
10	7	3	Florist	17	13	4
8	5	3	Sporting goods	19	15	4
9	4	5	Auto Parts	33	24	9
7	5	2	Auto Repair	34	31	3
11	5	6	Furniture Store	29	18	11
8	4	4	Jewellery Store	30	18	12
9	3	6	Shoe Repair	19	10	9
7	3	4	Fuel Dealer	13	4	9
8	3	5	Sheet Metal	23	15	8
5	2	3	Farm implements	6	2	4
6	3	3	Undertaker	8	5	3
6	3	3	Lawyer	38	26	12
5	3	2	Tavern	9	7	2
6	3	3	Real Estate	36	30	6

No. of occurrences			Functional Type	No. of Establishments		
NWO	LS	WS		NWO	LS	WS
6	3	3	Photographer	16	12	4
5	3	2	Optometrist	13	10	3
5	2	3	Veterinary	7	4	3
4	2	2	Animal Feed	8	6	2
4	3	1	Health Practitioner	9	8	1
4	2	2	Public Accountant	9	6	3
4	2	2	Music Shop	9	6	3
3	1	2	Frozen Food Locker	4	2	2
3	1	2	Fabric Shop	4	2	2
1	1	0	Bookstore	1	1	0
1	0	1	Art Shop	1	0	1
1	1	0	Specialised Machinery	2	2	0
1	1	0	Glass Shop	1	1	0
1	1	0	Business Supply	1	1	0
1	1	0	Specialised Ed. Inst.	1	1	0
1	1	0	Pet Shop	1	1	0
931	469	442		3,326	2,220	1,106

SERVICE CENTRE EQUIPMENT

Lakehead System	No. of Functional Types	No. of Establishments
Fifth Order		
Fort William	58	793
Port Arthur	56	789
Third Order		
Atikokan	39	93
Geraldton	37	87
Nipigon	32	81
Schreiber	32	59
Manitouwadge	32	52
Terrace Bay	27	42
Marathon	24	44
Second Order		
Longlac	17	27
Red Rock	16	22
Beardmore	15	21
Nakina	14	19
First Order		
Kakabeka Falls	7	14
Armstrong	8	8
Macdiarmid	7	7
Upsala	5	7
Rosslyn	4	4
Rossport	5	5
Murillo	3	3
Cameron Falls	3	3
Heron Bay	4	4
Heron Bay South	3	3
Jumbo Gardens	3	3
Pass Lake	2	3
Shebandowan	3	3
Stevens	3	3
Dorion	2	2
Jellicoe	2	2
Nolalu	2	3
South Gillies	2	3
Raith	2	2
Kaministikwia	1	2

	No. of Functional Types	No. of Establishments
Winnipeg System		
Fourth Order		
Dryden	49	149
Kenora	48	238
Fort Frances	46	232
Third Order		
Sioux Lookout	37	84
Red Lake	34	72
Rainy River	30	52
Second Order		
Emo	21	36
Keewatin	21	31
Vermilion Bay	19	34
Balmertown	19	21
Sioux Narrows	16	27
First Order		
Hudson	13	16
Nestor Falls	11	20
Ignace	8	15
Wabigoon	7	8
Pinewood	6	7
Eagle River	5	8
Madsen	5	6
Barwick	4	4
Bergland	4	4
Cochenour	4	5
Dinorwic	4	4
Ear Falls	4	4
Minnitaki	3	3
Stratton	3	4
Oxdrift	3	3
Black Hawk	3	3
Morson	3	3
Arbor Vitae	2	2
Devlin	2	2
Gameland	2	2
McKenzie Is.	2	2
Savant Lake	2	2
La Vallee	2	2

APPENDIX 10

FUNCTIONAL TYPES CHARACTERISING AND DIFFERENTIATING ORDERS OF SERVICE CENTRE IN NORTHWESTERN ONTARIO

Functional Type	Lakehead System Orders				Winnipeg System Orders			
	1	2	3	5	1	2	3	4
Filling station		1*	1	1		1*	1	1
Elementary school		1*	1	1		1*	1	1
Church		1*	1	1		1*	1	1
General store								
Food store		1*	1	1		1*	1	1
Meeting hall		1*	1	1		1*		1*
Restaurant		1*	1	1		1*	1	1
Hotel		1*	1	1				1*
Motel		1*	1	1		1*		1*
Barber shop		1*	1	1		1*	1	1
Bank			1*	1		1*	1	1
Beautician			1*	1			1*	1
Local taxi service			1*	1				1*
Physician			1*	1			1*	1
Apparel store			1*	1			1*	1
Hardware store			1*	1		1*	1	1
Insurance agency			1*	1			1*	1
Theatre		1*	1	1			1*	1
Drug store			1*	1			1*	1
Lumber yard			1*	1		1*	1	1
Laundry (omat)			1*	1				1*
Variety store		1*		1*			1*	1
Billiards & bowling				1*			1*	1
Appliance store				1*		1*		1*
Auto dealer			1*	1			1*	1
Department store				1*				1*
High school			1*	1			1*	1
Credit union			1*	1				1*
Dentist				1*				1*
Hospital & clinic				1*			1*	1
Dry cleaner			1*	1			1*	1
Freight line & storage				1*				1*
Bulk oil				1*				
Electric repair shop				1*				1*
Florist				1*				
Sporting goods				1*				
Auto parts				1*				1*
Auto repair				1*				
Furniture store				1*			1*	1
Jewellery				1*				1*
Shoe repair				1*			1*	1
Fuel dealer				1*				
Sheet metal				1*				
Farm implements				1*				
Undertaker				1*				1*
Lawyer				1*				1*
Tavern				1*				

Functional Type	Lakehead System Orders				Winnipeg System Orders			
	1	2	3	5	1	2	3	4
Real estate				1*				
Photographer				1*				1*
Optometrist				1*				
Veterinary				1*				
Animal feed				1*				
Health practitioner				1*				
Public accountant				1*				
Music shop				1*				

1 Characteristic functional type

* Differentiating functional type

APPENDIX 11

DETAILS OF SERVICE PROVISION

| | Filling station | Elementary school | Church | General store | Food store | Meeting hall | Restaurant | Hotel | Motel | Barber shop | Bank | Beautician | Local taxi service | Physician | Apparel store | Hardware store | Insurance agency | Theatre | Drug store | Lumber yard | Laundry (omat) | Variety store | Billiards & bowling | Appliance store | Auto dealer | Department store | High school | Credit union | Dentist | Hospital & clinic | Dry cleaner | Freight line & storage | Bulk oil | Electric repair shop | Florist | Sporting goods | Auto parts | Auto repair | Furniture store | Jewellery | Shoe repair | Fuel dealer | Sheet metal | Farm implements | Undertaker | Lawyer | Tavern | Real estate | Photographer | Optometrist | Veterinary | Animal feed | Health practitioner | Public accountant | Music shop | Frozen food locker | Fabric shop | Bookstore | Art shop | Specialized machinery | Glass shop | Business supply | Specialized ed. inst. | Pet shop |
|---|---|---

	Filling station	Elementary school	Church	General store	Food store	Meeting hall	Restaurant	Hotel	Motel	Barber shop	Bank	Beautician	Local taxi service	Physician	Apparel store	Hardware store	Insurance agency	Theatre	Drug store	Lumber yard	Laundry (omat)	Variety store	Billiards & bowling	Appliance store	Auto dealer	Department store	High school	Credit union	Dentist	Hospital & clinic	Dry cleaner	Freight line & storage	Bulk oil	Electric repair shop	Florist	Sporting goods	Auto parts	Auto repair	Furniture store	Jewellery	Shoe repair	Fuel dealer	Sheet metal	Farm implements	Undertaker	Lawyer	Tavern	Real estate	Photographer	Optometrist	Veterinary	Animal feed	Health practitioner	Public accountant	Music shop	Frozen food locker	Fabric shop	Bookstore	Art shop	Specialized machinery	Glass shop	Business supply	Specialized ed. inst.	Pet shop
Dryden	10	6	10		8	5	5	2	5	5	2	5	2	10	2	3	4	1	2	3	3	2	3	2	6	4	1	4	3	1	1	2		5	1		3	1	2	2	1		1	1	2																				
Kenora	16	9	13	2	14	8	15	6	12	7	4	9	1	9	12	4	10	1	4	1	3	6	3	4	6	2	2	8	6	2	4	3		1		2	2	1	4	3	1	2		1	4		4	2	1			1	1										
Fort Frances	15	8	13	3	16	6	12	7	6	5	3	5	6	10	13	3	7	1	3	4	4	4	3	8	6	2	1	8	3	2	3	5	1	4	2	2		3	5	2	5		1	6	1		1	2				2			1							
Sioux Lookout	1	2	4		6		7	3		3	2	4	5	2	3	2	3	1	1	2	1	2	2	1	2	1	1		1	2	2	3	4	1	1			1	2	2																						
Red Lake	5	2	9	4	4	2	2		1	2	2	2	1	6	4	1	2	1	2	1	1	3	2		1	1	1	1	1	1	2	2		1			1		1																						
Rainy River	2	2	4	1	3	4	4	2	1	2	1	2		2	1	2	2	1	1	1		2	1		1		1			1	1					1	3		1		1																				
Emo	3	1	3	2	2	3	2	1	1	2	1	1		2	2	1	1		1					2	2								2											1																			
Keewatin		2	3		4	2	1	2		1	1		1	1	1	1	3	2	1	1	1			1			1														1	1																					
Vermilion Bay	5	1	4	1		1	2		6	1	1		1			1				1	1	1	1	1												2						2																					
Balmertown	1	1	2		1	1	1		1	1	2	1	1		1			1	1	1			1	1						1												2																					
Sioux Narrows	2		1	4	2		4	2	2	1	1	1				1				1	1	1														1																											
Hudson	3	1	1	1		1	1	1			1	1					2								1						1	1																												
Nestor Falls	6	1	2	3	2		1		1			1				1								1								1																												
Ignace	2		2	1	2		3		3						1																				1																									
Wabigoon	2	1	1	1		1		1													1																																							
Pinewood	2	1	1	1	1	1																																																										
Eagle River		1	2	3										1				1																																														
Madsen		1	1	1	2																		1																																							
Barwick	1	1	1		1																																																								
Bergland		1	1	1		1																																																							
Cochenour	1		1	1			2																																																						
Dinorwic	1	1		1	1																																																							
Ear Falls				1	1			1	1																																																				
Minnitaki		1	1		1																																																								
Stratton	2	1	1																																																										
Oxdrift		1				1																																																							
Black Hawk		1	1	1																																																								
Morson				2			1																																																							
Arbor Vitae	1			1																																																								
Devlin	1				1																																																								
Gameland	1			1																																																								
McKenzie	1			1																																																								
Savant Lake				1			1																																																					
La Valle	1				1																																																							

APPENDIX 12

RAINY RIVER & LAKEHEAD DISPERSED POPULATIONS:

SUMMARY STATISTICS OF DISTANCE DATA (in miles)

RAINY RIVER

Item (Last buy)	n	$\bar{x}$	S.E.$\bar{x}$	s	o
Men's work clothes	79	19.8	3.4	30.2	30.4
Women's shoes	64	28.3	5.7	45.4	45.7
Men's shoes	86	24.6	4.1	37.4	37.6
Teenage girls' clothes	24	34.1	9.0	43.3	44.2
Children's clothes	40	16.5	2.2	13.9	14.0
Men's coat	71	41.6	7.2	60.4	60.8
Women's coat	67	57.0	8.8	71.8	72.3
Drugs	97	15.6	1.1	11.2	11.2
Groceries	101	10.3	1.0	10.0	10.1
Meat	85	12.4	1.3	11.5	11.5

Item (Most buy)	n	$\bar{x}$	S.E.$\bar{x}$	s	o
Men's work clothes	73	20.9	3.6	30.9	31.1
Women's shoes	65	18.9	3.2	25.4	25.6
Men's shoes	84	15.7	1.6	14.4	14.4
Teenage girls' clothes	20	24.1	9.0	39.2	40.2
Children's clothes	29	19.1	6.1	32.1	32.7
Men's coats	73	31.8	5.6	47.4	47.7
Women's coats	60	39.5	7.2	54.9	55.4
Drugs	98	15.7	1.1	11.3	11.3
Groceries	100	12.4	1.2	11.5	11.6
Meat	80	11.5	1.2	10.5	10.6

RAINY RIVER (cont.)

Item (Last buy)	n	$\bar{x}$	S.E.$\bar{x}$	s	o
Television	78	15.9	3.0	26.3	26.4
Refrigerator	92	24.7	4.4	41.9	42.1
Furniture	78	34.4	5.3	46.4	46.7
Watch	77	35.8	6.2	53.8	54.5
Jewellery	58	34.2	6.3	47.2	47.6
Car	92	62.3	7.7	73.5	73.9
Farm Machinery	69	21.5	3.4	28.0	28.2

Item (Last buy)	n	$\bar{x}$	S.E.$\bar{x}$	s	o
Doctor	100	19.3	2.9	28.9	29.1
Medical Specialist	46	183.6	9.4	63.3	64.0
Dentist	98	31.6	4.5	44.4	44.6
Lawyer	67	27.5	2.3	18.9	19.1
Car Insurance	90	14.0	1.1	10.3	10.4
Optometrist	80	35.6	4.7	41.7	41.9
Bank	98	19.8	2.5	24.5	24.6
Hospital	95	38.1	6.4	61.6	61.9

RAINY RIVER (cont.)

Item (Most buy)	n	$\bar{x}$	S.E.$\bar{x}$	s	o
Doctor	100	15.4	1.2	11.6	11.6
Medical Specialist	45	182.0	10.2	67.5	68.3
Dentist	99	27.3	3.3	33.0	33.2
Lawyer	69	27.4	2.3	18.9	19.0
Car Insurance	91	15.9	2.4	23.2	23.3
Optometrist	81	32.6	3.2	28.5	28.7
Bank	97	16.6	1.2	12.2	12.3
Hospital	98	17.7	2.1	20.5	20.6

THUNDER BAY

Item (Last buy)	n	$\bar{x}$	S.E.$\bar{x}$	s	o
Men's work clothes	178	12.7	1.6	21.2	21.3
Women's shoes	169	13.5	1.7	22.0	22.1
Men's shoes	175	13.6	1.8	24.0	24.1
Teenage girls' clothes	44	9.6	1.4	9.0	9.1
Children's clothes	108	10.6	1.0	10.7	10.8
Men's coat	175	12.3	1.2	16.2	16.2
Women's coat	165	12.4	1.4	18.4	18.5
Drugs	187	10.7	.8	10.5	10.6
Groceries	190	8.0	.6	8.1	8.1
Meat	181	7.9	.6	8.2	8.2

THUNDER BAY (cont.)

Item (Most buy)	n	$\bar{x}$	S.E.$\bar{x}$	s	o
Men's work clothes	182	11.8	1.3	17.7	17.8
Women's shoes	185	12.0	1.3	17.8	17.8
Men's shoes	186	13.1	1.6	21.3	21.4
Teenage girls' clothes	50	9.2	1.2	8.6	8.7
Children's clothes	113	10.1	1.0	10.4	10.4
Men's coats	183	11.3	.8	10.9	10.9
Women's coats	178	12.1	1.3	17.9	18.0
Drugs	188	10.8	.8	10.4	10.4
Groceries	187	8.3	.6	8.3	8.3
Meat	176	8.1	.6	8.2	8.3

Item (Last buy)	n	$\bar{x}$	S.E.$\bar{x}$	s	o
Television	170	14.5	2.9	38.0	38.1
Refrigerator	168	12.0	1.1	14.6	14.6
Furniture	178	11.3	.8	10.8	10.8
Watch	151	11.6	.9	11.4	11.4
Jewellery	129	10.0	.9	9.8	9.9
Car	171	14.1	1.5	20.1	20.2
Farm Machinery	59	13.4	1.4	10.7	10.7

THUNDER BAY (cont.)

Item (Last buy)	n	$\bar{x}$	S.E.$\bar{x}$	s	o
Family Doctor	189	11.2	.8	10.9	10.9
Medical Specialist	131	12.0	1.0	11.2	11.2
Dentist	167	11.9	1.1	14.5	14.5
Lawyer	147	12.4	.9	11.2	11.2
Car Insurance	175	11.1	.8	10.8	10.8
Optometrist	149	11.3	.9	10.7	10.7
Bank	187	11.1	.8	10.9	10.9
Hospital	180	11.5	.8	10.7	10.8

Item (Most buy)	n	$\bar{x}$	S.E.$\bar{x}$	s	o
Family Doctor	191	11.0	.8	10.7	10.8
Medical Specialist	135	11.7	1.0	11.1	11.2
Dentist	175	11.1	.8	10.4	10.5
Lawyer	153	12.5	.9	11.3	11.4
Car Insurance	179	11.1	.8	10.7	10.7
Optometrist	153	11.3	.9	10.6	10.6
Bank	187	11.1	.8	10.9	10.9
Hospital	186	11.3	.8	10.7	10.7

APPENDIX 13

RAINY RIVER AND LAKEHEAD DISPERSED POPULATIONS:

SETTLEMENT CHOICES OF SAMPLE POPULATIONS

RAINY RIVER

Item	L	FF	E	RR	W	O	T	C/P
Medical specialist								
Last buy	10	5	--	--	26	5	46	0
Most buy	11	6	--	--	27	1	45	
Optometrist								
Last buy	2	78	--	--	--	1	80	0
Most buy	1	79	--	--	--	1	81	0
Car								
Last buy	4	46	16	2	16*	8	92	0
Lawyer								
Last buy	--	68	0	1	--	--	69	0
Most buy	--	67	1	1	--	--	69	0
Women's coat								
Last buy	2	42	3	4	8	8	67	25
Most buy	--	47	3	3	5	2	60	35
Furniture								
Last buy	--	49	1	13	7	8	60	20
Jewellery								
Last buy	2	38	5	6	6	1	58	8
Dentist								
Last buy	1	45	4	6	5	37	98	0
Most buy	0	54	5	2	4	34	99	0
Men's coat								
Last buy	0	37	7	12	5	10	71	23
Most buy	0	47	8	9	4	5	73	22
Watch								
Last buy	1	41	8	6	6	5	77	14

* includes Steinbach .

	L	FF	E	RR	W	O	T	C/P
Refrigerator								
Last buy	2	43	8	12	3	24	92	6
Farm machinery								
Last buy	0	16	20	3	2	28	69	1
Men's work clothes								
Last buy	0	32	16	21	2	8	79	16
Most buy	0	38	12	13	1	9	73	23
Women's shoes								
Last buy	0	31	6	18	3	6	64	31
Most buy	0	33	8	19	2	3	65	30
Bank								
Last buy	0	48	21	28	0	1	98	0
Most buy	0	46	22	29	0	0	97	0
Teenage girls' clothes								
Last buy	0	17	2	4	0	1	24	11
Most buy	0	13	1	5	0	1	20	15
Drugs								
Last buy	0	30	43	21	0	3	97	0
Most buy	0	31	45	21	0	1	98	0
Children's clothes								
Last buy	0	23	3	14	0	1	41	8
Most buy	0	15	2	9	0	3	29	17
Hospital								
Last buy	4	28	42	9	4	8	95	0
Most buy	0	32	46	14	2	4	98	0
Car insurance								
Last buy	0	27	33	28	0	2	90	0
Most buy	1	27	34	29	0	0	91	0
Men's shoes								
Last buy	0	28	17	28	1	12	86	10
Most buy	0	33	17	26	0	8	84	12
Family doctor								
Last buy	1	30	50	13	0	6	100	0
Most buy	0	26	52	17	0	5	100	0
Television								
Last buy	1	24	16	12	2	23	78	7
Groceries								
Last buy	0	35	12	12	6	42	101	0
Most buy	0	41	14	10	0	35	100	0
Meat								
Last buy	0	33	12	13	0	27	85	0
Most buy	0	36	9	11	0	24	80	0

LAKEHEAD

Item	PA	FW	OTHER	T	C/P
Farm machinery					
Last buy	29	17	13	59	0
Car					
Last buy	116	52	3	171	0
Lawyer					
Last buy	68	78	1	147	0
Most buy	71	82	0	153	0
Medical specialist					
Last buy	61	67	3	131	0
Most buy	62	70	3	135	0
Television					
Last buy	86	71	13	170	0
Men's shoes					
Last buy	87	81	7	175	1
Most buy	92	91	3	186	0
Women's coat					
Last buy	83	81	1	165	3
Most buy	86	89	3	178	1
Refrigerator					
Last buy	92	67	9	168	2
Women's shoes					
Last buy	81	86	2	169	4
Most buy	85	96	4	185	2
Men's work clothes					
Last buy	80	92	6	178	1
Most buy	87	91	4	182	0
Watch					
Last buy	79	72	9	151	2
Optometrist					
Last buy	78	71	0	149	0
Most buy	75	78	0	153	0
Furniture					
Last buy	101	74	3	178	1
Men's coat					
Last buy	89	83	0	175	2
Most buy	90	92	1	183	1

Item	PA	FW	OTHER	T	C/P
Hospital					
Last buy	80	96	4	100	0
Most buy	84	99	3	186	0
Car insurance					
Last buy	89	80	6	175	0
Most buy	91	85	3	179	0
Dentist					
Last buy	70	90	7	167	0
Most buy	77	96	2	175	0
Bank					
Last buy	87	97	3	187	0
Most buy	88	97	2	187	0
Family doctor					
Last buy	81	98	10	189	0
Most buy	85	98	8	191	0
Drugs					
Last buy	79	102	6	187	0
Most buy	83	100	5	188	0
Teenage girls' clothes					
Last buy	23	21	0	44	1
Most buy	25	23	2	50	1
Children's clothes					
Last buy	50	54	4	108	4
Most buy	55	57	1	113	2
Jewellery					
Last buy	63	64	2	129	0
Groceries					
Last buy	64	81	40	190	0
Most buy	70	80	37	187	0
Meat					
Last buy	68	70	43	181	0
Most buy	66	72	38	176	0

APPENDIX 14

LAKEHEAD NEWSPAPERS' CIRCULATIONS, 1966-67

	News-Chronicle	*Times-Journal*
Port Arthur		
Fort William	195	216
Nipigon	344	184
Red Rock	192	172
Schreiber	92	271
Terrace Bay	170	168
Marathon	215	163
Manitouwadge	126	128
Beardmore	73	92
Geraldton	249	272
Longlac	27	135
Nakina	44	42
Armstrong	43	-
Atikokan	250	419
Ignace	41	56
Dryden	48	207
Sioux Lookout	36	39
Kenora	-	35
Red Lake	54	-
Fort Frances	-	217
Emo	-	29
Rainy River	-	60
Kakabeka Falls	47	146
Murillo	49	70
Total	2,295	3,121

Port Arthur	945
Fort William	69
Kaministikwia	95
Nipigon	76
Nolalu	34
Total	1,219

APPENDIX 15

DISTANCE DATA: MEAN DISTANCES (in miles)

Northwestern Ontario

	Extra-Nucleation	Travel	True
Mwc	72.7	26.7	23.9
Ws	85.0	37.2	32.9
Ms	74.4	29.1	27.1
Tgc	91.0	40.4	34.7
Cc	79.8	27.9	23.7
Mc	92.1	39.4	35.6
Wc	104.9	53.3	46.4
Drugs	48.7	15.8	15.8
Groc.	50.3	12.7	12.7
Meat	54.3	13.6	13.6
T.V.	68.5	23.6	22.9
Refrig.	79.7	32.5	31.1
Furn.	92.9	44.1	41.1
Wa	80.5	27.4	25.8
Jew.	81.0	29.2	28.2
Car	95.6	48.8	48.8
Fam.Doc.	51.4	16.7	16.7
Med.Spec.	145.3	117.4	117.4
Dentist	63.8	24.9	24.9
Lawyer	86.9	36.5	36.5
Car Ins.	59.9	23.6	23.1
Opt.	99.2	50.9	50.9
Bank	37.5	10.7	10.7
Hos.	51.3	17.7	17.7

Lakehead System

	Extra-Nucleation	Travel	True
Mwc	67.6	26.6	23.0
Ws	74.2	31.7	27.8
Ms	71.3	29.2	27.1
Tgc	74.0	30.2	27.0
Cc	71.5	26.8	23.0
Mc	75.6	32.5	29.7
Wc	75.9	37.7	33.5
Drugs	65.4	22.7	22.7
Groc.	65.1	22.6	22.6
Meat	67.3	23.1	23.1
T.V.	47.6	17.0	16.3
Refrig.	60.9	28.3	26.7
Furn.	74.5	38.1	35.7
Wa	72.8	26.5	24.8
Jew.	76.5	27.1	25.8
Car	65.6	34.8	34.8
Fam.Doc.	58.1	25.5	25.5
Med.Spec.	102.8	77.2	77.2
Dentist	62.8	25.6	25.6
Lawyer	94.3	44.3	44.3
Car Ins.	61.5	26.9	26.4
Opt.	97.2	49.5	49.5
Bank	52.6	17.2	17.2
Hos.	64.4	23.0	23.0

Winnipeg System

	Extra-Nucleation	Travel	True
Mwc	77.5	26.8	24.6
Ws	94.1	41.9	37.4
Ms	77.4	29.0	27.0
Tgc	103.4	49.0	51.4
Cc	88.9	29.0	24.3
Mc	107.5	45.9	41.1
Wc	129.2	66.9	57.5
Drugs	31.0	9.4	9.4
Groc.	21.5	3.5	3.5
Meat	29.6	4.9	4.9
T.V.	88.0	29.5	28.9
Refrig.	100.5	36.1	34.9
Furn.	111.8	49.2	45.8
Wa	86.9	28.1	26.6
Jew.	84.4	30.9	30.1
Car	122.8	60.5	60.5
Fam.Doc.	47.7	13.0	13.0
Med.Spec.	175.5	149.9	149.9
Dentist	64.9	24.2	24.2
Lawyer	77.7	28.9	28.9
Car Ins.	20.5	20.0	20.0
Opt.	101.0	52.1	52.1
Bank	19.1	4.7	4.7
Hos.	38.4	12.8	12.8

APPENDIX 16

STRUCTURE OF CONSUMER BEHAVIOUR: SUMMARY STATISTICS

Lakehead System	No.				Per cent	
Most buy	Total	HS	T	C	HS	T	C
Mwc	487	379	62	46	77.8	12.7	9.5
Ws	518	338	124	56	65.3	23.9	10.8
Ms	524	388	104	32	74.0	19.8	6.2
Tgc	222	156	43	23	70.3	19.4	10.3
Cc	387	279	57	51	72.1	14.7	13.2
Mc	507	347	126	34	6814	24.9	6.7
Wc	513	319	150	44	62.1	29.2	8.7
Drugs	562	480	82	-	84.4	14.6	-
Groc.	565	525	40	-	92.9	7.1	-
Meat	565	521	44	-	92.2	7.8	-
Last buy							
T.V.	502	368	120	14	73.3	23.9	2.8
Refrig.	499	326	151	22	65.3	30.3	4.4
Furn.	489	308	165	25	61.8	33.1	5.1
Wa	462	360	80	22	77.9	17.3	4.8
Jew.	442	333	95	14	75.3	21.5	3.2
Car	450	273	177	-	60.6	39.4	-
Most buy							
Fam.Doc.	563	493	70	-	87.6	12.4	-
Med.Spec.	412	190	222	-	46.0	64.0	-
Dentist	537	426	111	-	79.3	20.7	-
Lawyer	402	225	177	-	56.6	44.0	0
Car Ins.	501	374	118	9	74.7	23.6	1.7
Opt.	467	254	213	-	54.4	45.6	-
Bank	569	530	39	-	93.1	6.9	0
Hos.	550	442	108	-	80.4	19.6	-

		No.			Per cent		
Last buy	Total	HS	T	C	HS	T	C
Mwc	462	357	76	29	77.3	16.5	6.2
Ws	476	315	119	42	66.2	25.0	8.8
Ms	490	363	99	28	74.1	20.2	5.7
Tgc	193	118	52	23	61.1	26.9	12.0
Cc	381	264	71	46	69.3	18.6	12.1
Mc	473	303	135	35	64.1	28.5	7.4
Wc	477	282	157	38	59.1	32.9	8.0
Drugs	558	469	89	-	84.1	15.9	-
Groc.	568	522	46	-	91.9	8.1	-
Meat	562	512	50	-	91.1	8.9	-
Fam.Doc.	559	474	85	-	84.8	15.2	-
Med.Spec.	379	158	221	-	41.7	58.3	-
Dentist	517	403	114	-	77.9	22.1	-
Lawyer	372	229	143	0	61.6	38.4	0
Car Ins.	487	383	104	6	78.6	21.4	
Opt.	437	256	181	-	58.6	41.4	-
Bank	563	524	39	0	93.1	6.9	0
Hos.	515	408	107	0	79.2	20.8	-
Winnipeg System							
Most buy							
Mwc	372	274	77	21	73.7	20.7	5.6
Ws	389	249	96	44	64.0	24.7	11.3
Ms	390	290	77	23	74.4	19.7	5.9
Tgc	194	101	71	22	52.1	36.6	11.3
Cc	274	179	53	42	65.3	19.3	15.4
Mc	376	243	95	38	64.6	25.3	10.1
Wc	383	222	129	32	58.0	33.7	8.3
Drugs	427	382	45	-	89.5	10.5	-
Groc.	425	404	21	-	95.1	4.9	-
Meat	415	397	18	-	95.7	4.3	-

		No.			Per cent		
Last buy	Total	HS	T	C	HS	T	C
T.V.	385	302	75	8	78.4	19.5	2.1
Refrig.	386	286	89	11	74.1	23.1	2.8
Furn.	386	262	112	12	67.9	29.0	3.1
Wa	361	272	70	19	75.3	19.4	5.3
Jew.	371	287	75	9	77.4	20.2	2.4
Car							
Most buy							
Fam.Doc.	417	380	37	-	91.1	8.9	-
Med.Spec.	266	62	204	-	23.3	76.7	-
Dentist	424	301	123	-	71.0	29.0	-
Lawyer	268	202	66	0	75.4	24.6	0
Car Ins.	361	296	65	0	82.0	16.0	0
Opt.	354	224	130	-	63.3	36.7	-
Bank	411	397	14	0	96.6	3.4	0
Hos.	412	356	56	-	86.4	13.6	-
Last buy							
Mwc	356	252	78	26	70.8	21.9	7.3
Ws	384	227	121	36	63.8	34.0	2.2
Ms	386	270	94	22	69.9	24.4	5.7
Tgc	192	85	81	26	44.3	42.2	13.5
Cc	271	170	56	45	62.7	20.7	16.6
Mc	369	216	107	46	58.5	29.0	12.5
Wc	385	191	145	49	49.6	37.7	12.7
Dentist	424	378	46	-	89.2	10.8	-
Groc.	421	404	17	-	96.0	4.0	-
Meat	408	398	10	-	97.5	2.5	-

		No.			Per cent		
Last buy	Total	HS	T	C	HS	T	C
Fam.Doc.	415	375	40	-	90.4	9.6	
Med.Spec.	255	55	200	-	21.6	78.4	
Dentist	404	292	112	-	72.3	27.7	
Lawyer	246	181	65	0	81.6	26.4	
Car Ins.	358	292	66	2	62.7	18.4	0
Opt.	342	198	142	-	59.1	41.1	
Bank	418	396	22	0	94.7	5.3	
Hos.	401	320	81	-	79.8	20.2	

APPENDIX 17

DETAILS OF SPATIAL BEHAVIOUR ANALYSED IN CHAPTER FIVE

(Data in percentages)

Medical Specialist

Lakehead System

	HT	PA	FW	W	FF	Ger.
Port Arthur	92	-	8			
Fort William	88	12	-			
Atikokan	32	35	13	10	10	
Geraldton	-	96	4			
Nipigon	8	80	12			
Terrace Bay	14	77	9			
Schreiber	-	50	50			
Marathon	-	87	13			
Manitouwadge	6	82	12			
Longlac	-	93	7			
Nakina	-	60	10			30
Red Rock	-	60	40			
Beardmore	-	100				

Winnipeg System

	HT	W	Ken	FF	RL	PA	FW
Dryden	37	51	2			4	6
Fort Frances	20	71				9	
Kenora	24	76					
Sioux Lookout	11	89					
Red Lake	53	41				6	
Rainy River	6	88		6			
Keewatin	5	90	5				
Emo	-	100					
Balmertown	13	80			7		

Women's Coat

Lakehead System

	HT	PA	FW	Ger	Nip	Sch	KF	W	Cat
Port Arthur	96	-	3						1
Fort William	86	13	-						1
Atikokan	61	15	3						11
Geraldton	49	31							20
Nipigon	17	62	7				3		14
Terrace Bay	32	40	14			8	3		3
Schreiber	57	14	14						15
Marathon	20	50	10						20
Manitouwadge	56	18	4						22
Longlac	24	29	6	12					29
Nakina	-	30		20					50
Red Rock	9	75			8				8
Beardmore	9	82							9

Winnipeg System

	HT	W	Ken	FF	RL	IF	SL	PA	Cat
Dryden	75	22	1				1	1	
Fort Frances	73	11				2		2	12
Kenora	68	25							7
Sioux Lookout	48	35						3	14
Red Lake	59	27							14
Rainy River	32	32		9					27
Keewatin	3	33	57						7
Emo	18			46		9			27
Balmertown	20	40			40				

Lawyer

Lakehead System

	HT	PA	FW	Ger	FF
Port Arthur	94	-	6		
Fort William	90	10	-		
Atikokan	61	22	6		11
Geraldton	10	90			
Nipigon	18	74	8		
Terrace Bay	7	60	33		
Schreiber	0	50	50		
Marathon	4	83	13		
Manitouwadge	0	85	15		
Longlac	0	89		11	
Nakina		50		50	
Red Rock		91	9		
Beardmore		89		11	

Winnipeg System

	HT	W	FF	Dry	Ken	PA	FW	At
Dryden	92	3			1	3		
Fort Frances	98							2
Kenora	97	3						
Sioux Lookout	0	9		73	9		9	
Red Lake	67	8		17		8		
Rainy River	0	16	84					
Keewatin	0		18		82			
Emo	0							
Balmertown	0			100				

Women's Shoes

Lakehead System

	HT	PA	FW	Ger	Nip	Sch	KF	Cat
Port Arthur	100							
Fort William	88	10						2
Atikokan	66	16	6					12
Geraldton	43	29						28
Nipigon	18	61	4				3	14
Terrace Bay	35	42	10				3	10
Schreiber	57	14	7					22
Marathon	24	42	10					24
Manitouwadge	59	13	8					20
Longlac	37	25		6				32
Nakina	17	17		17				49
Red Rock	21	59	3	6				11
Beardmore	37	37						26

Winnipeg System

	HT	W	Ken	FF	RL	Emo	Dry	IF	FW	PA	At	Cat
Dryden	66	14	3						1			16
Fort Frances	67	10				2		6	2	2	2	9
Kenora	83	15										2
Sioux Lookout	74	16								3		7
Red Lake	61	13										26
Rainy River	77	6										17
Keewatin	-	7	93									
Emo	31			47								22
Balmertown	20	15			30		5					30

Men's Shoes

Lakehead system

	HT	PA	FW	Ger	Nip	Sch	KF	W	FF	Cat
Port Arthur	96	-	4							
Fort William	93	7	-							
Atikokan	79	6	3					3	3	6
Geraldton	70	15								15
Nipigon	54	32	7				3			4
Terrace Bay	52	21	10			7				10
Schreiber	72	7	7							14
Marathon	38	40	6							16
Manitouwadge	69	14	3							14
Longlac	63	25		6						6
Nakina	0	17		33						50
Red Rock	30	56	4		7		3			
Beardmore	42	42								16

Winnipeg System

	HT	W	FF	Emo	At	Ken	IF	PA	FW	RL	Cat
Dryden	81	8				1			2		8
Fort Frances	80	2		10	2		2				4
Kenora	85	15									
Sioux Lookout	97										3
Red Lake	69	7									24
Rainy River	79	4	4								13
Keewatin	15	6			79						
Emo	50		50								
Balmertown	26	16								37	21

D entist

Lakehead System

	HT	PA	FW	Ger	Long	RR	Ter.B	Sch	W	FF
Port Arthur	94	-	6							
Fort William	94	6								
Atikokan	78	8	2						6	6
Geraldton	84	9			7					
Nipigon	21	61	14			4				
Terrace Bay	84	7	7					2		
Schreiber	56	6	13				25			
Marathon	88	12								
Manitouwadge	100									
Longlac	77			23						
Nakina	0			55	45					
Red Rock	45	41	14							
Beardmore	0	67	8	25						

Winnipeg System

	HT	W	FF	E	Ken	Bal	IF	Bau	PA	RL	Dry
Dryden	95	4							1		
Fort Frances	78	2		3			17				
Kenora	95	5									
Sioux Lookout	74	26									
Red Lake	85	11			2						2
Rainy River	0		5				8	87			
Keewatin	0				100						
Emo	0		92				8				
Balmertown	79									21	

Groceries

Lakehead System

	HT	PA	FW	Ger	Nip	Ter.B	W
Port Arthur	99		1				
Fort William	97	3	-				
Atikokan	97						3
Geraldton	100						
Nipigon	90	10					
Terrace Bay	100						
Schreiber	100						
Marathon	97					3	
Manitouwadge	97	3					
Longlac	76	7		17			
Nakina	80			20			
Red Rock	35	32	4		29		
Beardmore	58	8		8	24		

Winnipeg System

	HT	W	FF	Emo	At	Ken	SL	RL
Dryden	99						1	
Fort Frances	92			6	2			
Kenora	100							
Sioux Lookout	100							
Red Lake	92	8						
Rainy River	96		4					
Keewatin	91					9		
Emo	76		24					
Balmertown	65							35

Bank

Lakehead System

	HT	PA	FW	Ger	Long	Nip	Sch	Red.R	KF
Port Arthur	97	-	3						
Fort William	98	2							
Atikokan	100								
Geraldton	87	9			4				
Nipigon	84							13	3
Terrace Bay	94		3				3		
Schreiber	100								
Marathon	97	3							
Manitouwadge	100								
Longlac	94			6					
Nakina	0		8	92					
Red Rock	88	4				8			
Beardmore	92					8			

Winnipeg System

	HT	W	FF	RL	At	Ken
Dryden	99					1
Fort Frances	98				2	
Kenora	100					
Sioux Lookout	100					
Red Lake	100					
Rainy River	91	5	4			
Keewatin	75					25
Emo	85		15			
Balmertown	95			5		

SOURCES

Abbreviated textual references to substantive and methodological works are fully amplified at the end of each chapter. A comprehensive list of works cited is provided here and it is expanded to include useful works relevant to the study of Northwestern Ontario, which were consulted but not referred to in the text.

Abbreviated textual references to sources are amplified at the end of each chapter and a comprehensive guide is assembled here.

A comprehensive guide to the maps and plans utilised by the writer preparatory to and during field work, and in the production of the figures presented in Volume II, is also presented here.

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TOPOGRAPHIC MAPS

Name of Map	Reference and Edition		Dates of Print
Scale 1:506,880			
English Bay	52NW	2nd ed.	1943, reprint 1951
Geraldton-White River	42SW		1940
Kowkash-Martin Falls	42NW	Base Map, 1st ed. new eds.	1944 1949, 1952
Thunder Bay District	Map 23	Dept. of Lands & Forests	1963
Pickle Crow-Armstrong	52NE	2nd ed.	1944, rev. 1952
Rainy River, Kenora & Part of Kenora, Patricia Portion	Map 24	Dept. of Lands & Forests	1962
Scale 1:500,000			
English River (elevation sheet)	52NW	Base Map, 3rd ed.	1965
Geraldton-White River (elevation sheet)	42SW	2nd ed., Base Map 1st ed., minor rev.	1940 1961
Ignace-Fort William	52SE	2nd ed.	1940 rev. 1950, 1952
Kenora-Fort Frances	52SW	3rd ed.	1942 rev. 1948, 1951
Kenora-Fort Frances (elevation sheet)	52SW	Base Map, 4th ed.	1966
Kowkash-Martin Falls (elevation sheet)	42NW	Base Map, 4th ed.	1968
Thunder Bay (elevation sheet)	52SE	Base Map, 3rd ed.	1970
Pickle Crow-Armstrong	52NE	2nd ed.	1944, rev. 1952

Name of Map	Reference and Edition		Dates of Print
Pickle Crow-Armstrong	52NE	Base Map, 3rd ed.	1968
Scale 1:253,440			
Carroll Lake Manitoba-Ontario	52M	Prov. ed.	1926, reprint 1940, corrected 1950
Dryden	52F	Prov. ed.	1930, reprint 1946, corrected 1948
Lake St. Joseph	52O	Prov. ed.	1929, rev. 1942
Longlac	42E	Prov. ed.	1938
Mimíniska	52P	Prov. ed.	1932, rev. 1947
Pointe Du Bois	52L	Prelim. Map, 4th ed.	1932, rev. 1948 minor rev. 1951
Rainy River	52D	Prelim. Map, 3rd ed.	1931, reprint 1940, rev. 1951
Sioux Lookout	52J	Prov.	1928, reprint 1939
Trout Lake	52N2		1927, rev. 1948
Scale 1:250,000			
Armstrong	52I	4th ed., Series A501	1966
Dryden	52F	4th ed.	1965
Fort Hope	42M	Prelim. Map, 2nd ed., Base Map, 1st ed.	1942, reprint 1952
Ignace	52G	5th ed., Military Sheet, no legend	
Ignace	52G	5th ed.	1965
International Falls	52C	4th ed., Series A501	1967
Kenora (Canada-United States)	52E	5th ed., Series A501	1966

Name of Map	Reference and Edition		Dates of Print
Lac Seul	52K	5th ed., Series A501	1964
Nakina	42L	Prelim. Map, 3rd ed.	1934, 1949, rev. 1957
Nipigon	52H	Prelim. Map, 3rd ed.	1962
Quetico	52B	6th ed.	1964
	52B	5th ed., Prelim. Map	1957
Thunder Cape	52A/7	West 3rd ed. Series A751	1952
	52A/7	East 3rd ed.	1952
Scale 1:126,720			
Port Arthur	52A/SW	revised reprint	1939 1947 1943
Hornepayne	42F/SE	1st ed.	1965
Kaministiquia	52A/NW		1939, rev. 1949
Longlac	42E/NE	1st ed.	1953
Pukaskwa River	42C/SW	Prelim. Map, 2nd ed.	1956
Roslyn Lake	42E/SW	1st ed., Prelim. Map Dept. of Lands & Forests	1953
Steel Lake	42E/SE	1st ed., Prelim. Map, Dept. of Lands & Forests	1952
White River	42C/NW	Prelim. Map, 1st ed., Dept. of Lands & Forests	1956
Scale 1:63,360			
Fort William	Publication No. 2021		1925

Name of Map	Reference and Edition		Dates of Print
Scale 1:50,000			
East Bay	52A/14E	Prov.	1959
	52A/14W	Prov.	1959
Firesteel River	52G/2W	Prov.	1959
	52G/2E	Prov.	1959
Jarvis River	52A/3W	2nd ed., Series A751	prod. 1958-61
	52A/3E	2nd ed.	prod. 1958-61
Kakabeka Falls	52A/5E	Prov. 2nd ed.	1959, rev. 1969
	52A/5W	Prov. 1st ed.	1959
Loon	52A/10W	Prov. 1st ed.	1959
	52A/10E	Prov. 1st ed.	1959
Nipigon	52H/1W	Series A751	1966
Onion Lake	52A/11E	Prov. 1st ed.	1959
	52A/11W	Prov. 1st ed.	1959
Pigeon River	52A/4W	2nd ed., Series A751	prod. 1958-61
	52A/4E	2nd ed., Series A751	prod. 1958-61
Raith	52A/13W	Prov. 1st ed.	1959
Sunshine	52A/12W	Prov. 1st ed.	1959
	52A/12E	Prov. 1st ed.	1959
Thunder Cape	52A/7N	Prov. 2nd ed.	1958
	52A/7E	Prov. 2nd ed.	1958
Twin Cities	52A/6W	3rd ed.	prod. 1957-61
	52A/6E	3rd ed.	prod. 1957-61
Upsala	52G/1W	Prov.	1959
	52G/1E	Prov.	1959
Wolf River	52A/15W	Prov. 1st ed.	1959
	52A/15E	Prov. 1st ed.	1959
Scale 1:31,680			
Miniss Bay Sheet Lake St. Joseph	Map 2159 Ontario Dept. of Mines & Geological Survey of Canada		1968

Name of Map	Reference and Edition	Dates of Print
Roadhouse Lake Sheet	Map 2157 Ontario Dept. of Mines & Geological Survey of Canada	1967

TOWNSHIP PLANS

Rainy River District

Name of Township	Surveyor and Date
Scale 1 in. = 40 chains	
Atwood	C.C. Forneri, D.S.*, Aug. 7, 1874
Aylsworth	
Blue	E. Stewart, D.S., Jan. & Feb., 1876
Burriss	W. Hopkins, O.L.S., Rat Portage
Carpenter	H.B. Proudfoot, P.L.S., Toronto, Dec. 3, 1891
Crozier	C.C. Forneri, D.S., Aug. 7, 1876
Curran	C.C. Forneri, D.S., Aug. 7, 1876
Dance	
Devlin	C.C. Forneri, D.S., Aug. 11, 1876
Dewart	A. Lougheed, O.L.S., Port Arthur, Jan. 25, 1904
Dilke	C.C. Forneri, D.S., Aug. 8, 1876
Dobie	H.B. Proudfoot, P.L.S., Toronto, Nov. 1891

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* D.S. - Department Surveyor
O.L.S. - Ontario Land Surveyor
P.L.S. - Provincial Land Surveyor

Name of Township	Surveyor and Date
Kingsford	
Lash	C.C. Forneri, D.S., Aug. 7, 1876
Mather	1939
Miscampbell	
Morley	
Morson	W. Murdoch, D.L.S., O.L.S., Bowmanville
McCrosson	H.B. Proudfoot, O.L.S., Toronto, Nov. 1, 1893
McIrvine	Dept. Mines, Ontario, (Fort Frances Mining Div.)
Nelles	Elihu Stewart, D.S., Jan., 1876
Pattullo	Elihu Stewart, D.S., March & April, 1876
Potts	
Pratt	H.B. Proudfoot, O.L.S., Toronto, Dec. 1, 1893
Richardson	W.J. Gillon, O.L.S., Fort Frances, Dec. 28, 1903
Roddick	
Shenston	E. Stewart, D.S., March & April, 1876
Sifton	
Spohn	H.B. Proudfoot, O.L.S., Toronto, Dec. 1, 1892
Sutherland	T.R. Deacon, O.L.S., Rat Portage, Oct. 4, 1899
Tait	E. Stewart, D.S., March, 1876
Tovell	A. Lougheed, O.L.S., Port Arthur, Jan. 29, 1904
Woodyatt	
Worthington	C.C. Forneri, D.S., Aug. 11, 1876

Kenora District

Name of Township	Surveyor and Date
Scale 1 in. = 40 chains	
Aubrey	
Britton	A.T. Ward, O.L.S., Feb. 4, 1904
Eton	T.B. Speight, O.L.S., 1896
Langton	Improved roads surveyed by R.S. Kirkup, O.L.S., 1915
Mutrie	Dept. Mines, Ontario
Rugby	A.H. MacDougall, O.L.S., Nov. 20, 1896
Sanford	G. McCubbine, O.L.S., 1897
Temple	
Van Horne	
Wainwright	T.B. Speight, O.L.S., Toronto, Oct. 18, 1895
Wabigoon	Improved roads surveyed by R.S. Kirkup, O.L.S., 1929
Zealand	

Thunder Bay District

Name of Township	Surveyor and Date
Scale 1 in. = 40 chains (unless otherwise noted)	
Blake	Lakehead Planning Board (4 ins. = 1 ml.)
Conmee	Thunder Bay Mining Division
Crooks	Dept. of Lands & Forests
Devon	Dept. of Mines, Plan M. 1695
Dorion	Dept. of Mines, April, 1912

Name of Township	Surveyor and Date
Forbes	Phillips & Bennei, Dec., 1915 Rev. R.S. Kirkup, 1932
Fowler	Phillips & Bennei, 1919
Gorham	Dept. of Mines
Jacques	Dept. of Mines, 1955
MacGregor	Dept. of Mines, Plan M. 1813, 1912
McIntyre	Lakehead Planning Board, Oct., 1963 4 ins. = 1 ml.
McTavish	Lakehead Planning Board, Nov., 1959
Neebing	1 in. = 600 ft.
O'Connor	Dept. of Mines, Plan M. 1843
Oliver	J.F. Francis, P.L.S., Oct., 1873 Rev. 1939
Paipoonge	Lakehead Planning Board, Oct., 1966 4 ins. = 1 ml.
Pardee	Dept. of Mines, Plan M. 1856, 1960
Pearson	A.H. MacDougall, O.L.S., 1904 Roads rev. R.S. Kirkup, O.L.S., 1932
Scoble	Port Arthur Mining Div.
Strange	Dept. of Lands & Forests
Ware	Dept. of Mines

TOWN PLANS

Name of Town	Surveyor, Date and Scale
Atikokan	1" = 100'
Balmertown	G.R. Bradshaw, Aug., 1952, 1" = 100'
Beardmore	1948, traced from plan dated May, 1947 1" = 100'

Name of Town	Surveyor, Date and Scale
Cochenour	Cochenour-Williams Gold Mines Ltd., June, 1964, 1" = 100'
Dryden	Nov., 1962, 1" = 200'
Fort Frances	Project Planning Associated (Toronto), 1964, 1" = 600'
Geraldton	J.W. Kilkenny, O.L.S., 1938, rev. 1952 by H. Hamilton, 1" = 400'
Kakabeka Falls	1" = 200'
Kenora	J.A. McCoombs, M.E., 1952, rev. 1965, 1" = 600'
Longlac	R.L. Beach, 1957, rev. 1967, 1" = 400'
Manitouwadge	Manitouwadge I.D. D.A., 1960, 1" = 300'
Marathon	Engineering Dept., 1957, rev. 1958, 1960, 1962, 1966, 1" = 200'
Nipigon	1" = 200'
Red Lake	1" = 500'
Red Rock	R.E. Abbot, Nov., 1947, with undated revisions, 1" = 100'
Schreiber	Drawn - U.J.K., Feb., 1963, 1" = 200'
Terrace Bay	Kimberly-Clark Co., 1965, revisions of diag. No. LL275 - L - 1D 1" = 200'
Fort William	Fort William Planning Dept., 1966 1" = 800'
Port Arthur	Port Arthur Planning Dept., 1965 1" = 800'